Bering Straits Coastal Resource Service Area Board

John Auliye with grandchildren Annette Koutchak and Billy Cooper, Unalakleet. (Chuck Degnan photo)

Conceptually Approved

Volume 2 — Resource Analysis

October 1986

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Bering Straits Coastal Resource Service Area Board

Bering Straits Coastal Resource Service Area
Coastal Management Program

The Coastal Management Program of the Bering Straits CRSA is comprised of three volumes:

VOLUME 1: **RESOURCE INVENTORY** - This volume, distributed in October 1984, provides an inventory of the resources of the region in both narrative and mapped format as an oversized atlas.

VOLUME 2: **RESOURCE ANALYSIS** - Distributed in October 1985, this volume examines the potential impacts of uses and activities on the resources of the region.

VOLUME 3: **COASTAL MANAGEMENT PLAN** - Distributed in October 1985, this volume describes the development of the Coastal Management Program, identifies the coastal area boundary, and provides the policies and implementation procedures for the plan.

Volume 2:
Concept-Approved Resource Analysis for the Bering Straits Coastal Resource Service Area

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TABLE OF CONTENTS

Volume 2: Resource Analysis for the Bering Straits CRSA Coastal Management Plan

Title Page i

Table of Contents ii

List of Tables vii

List of Maps vii

Acknowledgements viii

Chapter 1: Introduction and Organization

Chapter 2: Subsistence

2.1 Issues and Concerns 2-1

2.2 Subsistence Economy and Lifestyle 2-1

2.3 Impacts to Subsistence Resources 2-5

2.4 Ability of Resources to Sustain Harvest Demands 2-9

2.4.1 Marine Mammals 2-9

2.4.2 Fish and Shellfish 2-10

2.4.3 Land Mammals 2-10

2.4.4 Birds 2-11

2.4.5 Vegetation and Timber 2-11

Chapter 3: Coastal Habitats

3.1 Issues and Concerns 3-1

3.2 Habitat Sensitivity and Vulnerability 3-1

3.2.1 Offshore Areas 3-1

3.2.2 Estuaries 3-2

3.2.3 Wetlands and Tideflats 3-3

3.2.4 Barrier Islands and Lagoons 3-3

3.2.5 High-Energy Coast 3-4

3.2.6 Rocky Islands and Sea Cliffs 3-4

3.2.7 Rivers, Lakes, and Streams 3-5

3.2.8 Upland Habitats 3-5

Chapter 4: Reindeer Herding

4.1 Issues and Concerns 4-1

4.2 Essential Reindeer Habitats 4-1

4.3 Conflicts With Other Wildlife 4-1

4.4 Expanding Markets For Reindeer 4-2

Chapter 5: Cultural and Historic Resources

5.1 Issues and Concerns 5-1

5.2 Prehistory 5-1

5.3 Traditional Tribal Organization 5-2

5.4 History 5-4

5.4.1 European Contact 5-4

5.4.2 World War II to Present 5-6

5.5 Cultural Sites 5-6

5.6 Methods of Minimizing Impacts 5-7

Chapter 6: Oil and Gas Development

6.1 Issues and Concerns 6-1

6.2 Hydrocarbon Potential 6-1

6.3 Potential Development Scenarios 6-2

6.4 Oil Spill Potential 6-3

6.5 Social - Economic Effects 6-4

6.6 Employment Opportunities 6-5

6.7 Subsistence Conflicts 6-5

6.8 Environmental Effects 6-5

6.8.1 Effects of Noise 6-6

6.8.2 Effects of Oil Spills 6-8

6.8.2.1 Marine Mammals 6-8

6.8.2.2 Fish and Shellfish 6-9

6.8.2.3 Birds 6-11

6.6 Methods For Minimizing Impacts 6-11

Chapter 7.0: Mining and Mineral Development

7.1 Issues and Concerns 7-1

7.2 Mineral Potential 7-1

7.3 Socioeconomic and Cultural Changes 7-2

7.4 Economic and Technical Feasibility 7-5

7.5 Mining Activities 7-6

7.5.1 Placer Mining 7-6

7.5.2 Sand and Gravel Extraction 7-7

7.5.3 Offshore Mining and Dredging 7-7

7.5.4 Lode (Hardrock Mining) 7-7

7.5.5 Strip Mining 7-8

7.6 Potential Environmental Effects of Mining 7-8

7.6.1 Maintenance of Water Quality 7-8

7.6.2 Maintenance of Air Quality 7-8

7.6.3 Habitat Alteration 7-10

7.6.4 Effects on Anadromous and Freshwater Fish . . . 7-10

7.6.5 Effects on Marine Fish and Shellfish . . . 7-11

7.6.6 Effects on Marine Mammals . . . 7-11

7.6.7 Effects on Land Mammals . . . 7-12

7.6.8 Effects on Birds . . . 7-13

Chapter 8: Transportation

8.1 Issues and Concerns . . . 8-1

8.2 Transportation Needs . . . 8-1

8.3 Facilities Needed for Resource Development . . . 8-1

8.4 Potential Effects of an Expanded Transportation System . . . 8-2

8.4.1 Subsistence Access . . . 8-2

8.4.2 Recreation . . . 8-2

8.4.3 Economies in Freight Movement . . . 8-2

8.4.4 Emergency Response . . . 8-2

8.4.5 Reduced Isolation . . . 8-2

8.4.6 Vessel Traffic . . . 8-3

8.4.7 Altered Water Circulation . . . 8-3

8.4.8 Erosion and Sedimentation . . . 8-3

8.4.9 Habitat Loss . . . 8-3

8.4.10 Natural Hazards . . . 8-4

8.4.11 Noise . . . 8-4

8.4.12 Material Extraction, Thaw Collapse, and Drainage . . . 8-4

8.4.13 Dust . . . 8-4

8.5 Methods for Minimizing Impacts . . . 8-4

Chapter 9: Commercial Fishing

9.1 Issues and Concerns 9-1

9.2.1 Effects on Subsistence and Sport Fisheries 9-1

9.2.2 Local Participation in the Fisheries 9-2

9.2.3 Effects of Resource Development on Regional Fisheries 9-2

9.2.4 Conflicts with Commercial Fishing 9-2

9.3 Aquaculture 9-4

9.4 Environmental Effects of Seafood Processing 9-4

Chapter 10: Outdoor Recreation

10.1 Issues and Concerns 10-1

10.3 Impacts of Development Activities 10-1

10.4 Economic Benefits 10-2

Chapter 11: Land Ownership and Management

11.1 Issues and Concerns 11-1

11.2 Effects on Subsistence 11-1

11.3 Effects on Resource Development 11-1

11.4 Effects on Reindeer 11-2

11.5 Effects on Recreation 11-2

11.6 Implications of 1991 11-2

11.7 Need for Coordination 11-2

11.8 Methods of Minimizing Impacts 11-2

Chapter 12: New Settlements

12.1 Issues and Concerns 12-1

12.2 Proposed Settlement Areas 12-1

Chapter 13: Bibliography 13-1

LIST OF TABLES

Table 2-1 Subsistence Research Issues 2-6

Table 2-2 Resources Used in the Bering Straits Region and Their Relative Sensitivity to Three Types of Disturbance 2-9

Table 6-1 Expected Impacts of Oil Development on Common Birds in Norton Sound 6-12

Table 7-1 Minimizing Human Activity Near Sensitive Species When They Are Most Vulnerable to Noise and Disturbance 7-9

LIST OF MAPS

Map 3-1 Anadromous Fish Distribution 3-7

Map 4-1 Reindeer Grazing Allotments 4-3

Map 5-1 Cultural and Historical Sites 5-9

Map 7-1 High Potential Mineral Areas 7-3

Map 9-1 Commercial Fishing Districts 9-3

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Chapter 1: Introduction and Organization

A necessary prerequisite to the establishment of a sound resource management plan is an understanding of potential impacts of proposed actions and the identification and implementation of effective mitigating measures. This Resource Analysis analyzes existing and potential development from a broad perspective to present the current state of knowledge concerning anticipated uses and activities of the lands and waters within the Bering Straits CRSA. The chapters of the Resource Analysis are organized by subject uses where the focus is on specific types of resource development and use. Concerns identified in the Resource Analysis are addressed in policies of the coastal management plan presented in Volume 3.

Major issues and concerns addressed in this analysis examine whether potential development activities and uses will:

- reduce habitat productivity;
- reduce subsistence resources;
- reduce commercial fish resources;
- reduce availability/access of subsistence resources;
- reduce availability/access of commercial fish resources;
- adversely impact subsistence-based village economies; and
- disrupt cultural and traditional values of indigenous societies.

The discussions presented in this document are not intended to provide comprehensive analyses for all issues and impacts. Nor do they imply that impacts from resource development activities are inevitable; cooperation between industry and federal, state, and local government has often resulted in preventing or minimizing impacts. Rather, the intent is to provide a basic working tool for recognition of concerns associated with development activities in the Bering Straits CRSA Region.

Chapter 2: Subsistence

2.1 ISSUES AND CONCERNS

Major issues and concerns are:

- potential effects of resource development and other activities on subsistence resources; and
- continued adequacy of habitats and fish and wildlife resources to meet subsistence needs.

2.2 SUBSISTENCE ECONOMY AND LIFESTYLE

An understanding of the interrelationship between subsistence and monetary economies is essential to the development of informed policy formation and the development of regulations to implement policy. Due to a research orientation that focuses on subsistence from a historical rather than a contemporary perspective, that understanding is lacking. No longer can the economic, social, and ideological structures of today's indigenous societies be categorized from a historical perspective. New and additional research is needed to develop an understanding of geographic distribution and to document the ramification of other systems on them. Wort (1982) offers a glimpse of that understanding when she states:

"Without an understanding of existing subsistence economies and their interrelationship with social and cultural elements, it is not possible to estimate trends and magnitudes of exchange or the effects of massive development projects. In reality, economic, social, and ideological structures are different today from the traditional systems described in the historical literature, but existing data of most regional subsistence economies is insufficient to describe the new forms, their ramifications on other system elements, and their regional geographic distribution. The task of impact assessment of new developments on subsistence economies is quite problematic. Long-term and cumulative effects of impacts may not be immediately discernable..."

"Culture is comprised of a system of interacting elements, and local productive systems are linked to social and cultural elements. Cultural values and ideologies of Alaskan natives are embedded in their relationship to the land and wildlife and in the interrelationship among extended family and community. The collective effects of development forces which serve to decrease subsistence production and distribution may stress and weaken cultural values such as sharing and cooperative behavior among extended family members. Continuous, long-term environmental and wildlife impacts may adversely affect socialization and training of the young. Cultural values may not be transmitted and instilled."

The Bering Straits Region has long been recognized as a cultural hearth of major significance to indigenous cultures and traditions (Giddings 1960). Tornfelt (1981) suggests that Asian migrants to the Bering Straits region may have arrived as early as 10,000 to 15,000 years ago. Cultural sites dating back as far as 5000 B.C. have been identified in the Bering Sea Region (State of Alaska 1984). There is archaeological evidence of human inhabitancy belonging to distinct cultural groups in the Bering Straits Region dating back to 3100 B.C. (Gidding 1960). At least since 400 B.C., there has been a continuous subsistence economy evolving around marine mammals, anadromous fish and caribou (Bockstoce 1973, 1979; Ellanna 1983).

Early subsistence economies were characterized by community mobility, variety, flexibility of food gathering techniques, and the availability of many alternative subsistence patterns (Ray 1984). The research work of Bockstoce (1973, 1979) and Ray (1964) indicates that settlement patterns were very mobile, and that they evolved around a central permanent village, seasonal villages and individual camps, and special use areas within a recognizable territory.

In the Bering Straits Region, the central/permanent village was of great social, spiritual, and physical importance (Lutz 1973, Ray 1964). Regardless of where one traveled or moved, the central/permanent village was considered "home" (Ray, 1964). Through affiliation with a community, individuals survived; through affiliation with individuals, the community survived. While the physical site location of a community often changed for a variety of reasons (Ray 1964), allegiance to a community was constant and permanent.

Each community had a territory that was recognized and respected by adjacent communities. Territorial boundaries were generally along mountain ridges and watersheds, as well as arbitrary points established through traditional use. Only in strict accordance with established traditions could the territory of another be entered with impunity (Ray 1964).

Giddings (1960) documents that the culture of present indigenous societies in the Bering Straits Region evolved slowly from early hunting and fishing societies. These early societies showed remarkable talent in producing specialized and sophisticated artifacts for harvesting resources from the seas, streams, tundra, and forests of the region. The ability of indigenous societies to adapt to changing environmental conditions in increasingly sophisticated manners is predominant in the archaeological literatures.

There is archaeological evidence (Giddings 1960) documenting an extensive circumpolar trading network and participation in localized cultural events between indigenous societies (Ray 1964). Trade routes, trading fairs, trading partners, and intercommunity feasts were common forums where ideas, as well as goods, were exchanged and cooperation between participating groups and individuals was reinforced (Giddings 1960, Langdon and Worl 1981, Thomas 1982, Ray 1964).

The literature is replete with accounts of the effects of continuing contact between indigenous populations and western society. Each contact period resulted in alterations to the fabric of these societies. However, throughout these periods of contact, including contemporary society, indigenous cultures have maintained a close tie and special relationship with the land. Ray (1964) attributes this internal cultural integrity to the great value placed on initiative; the ability to adapt, the constant emphasis on intra-tribal tranquility and interpersonal relations, the presence of a number of prevailing alternatives in the subsistence quest, and the flexibility of the settlement pattern with the subsistence pattern.

In the 19th century, contact between indigenous populations and western society increased. Continous contact between western society and the region's indigenous societies resulted primarily from the interest of western societies interest in the extraction and procurement of the region's natural resources (DOI 1985c, Langdon and Worl 1981, Thomas 1982). The establishment of schools, churches and stores tended to consolidate smaller, more mobile communities into larger, less mobile, permanent communities (Thomas 1982). This type of settlement pattern evenitally led to the development of St. Michael, Unalakleet, Teller, and Nome as trade centers serving the region (DOI 1985a).

In most regions, a single community emerged as the administrative center for the region. These regional centers house federal and state agencies and provide links to statewide transportation systems. Such regional centers are often characterized as being ethnically-diverse with more dependence on a cash economy (Worl 1982). As time, economic trends, and technological advances progressed, Nome emerged as the recognized regional hub of commerce and trade for the Bering Straits Region. Unalakleet continues to evolve into a subregional center for the inner Norton Sound, while Teller and St. Michael are now considered remote, rural villages.

Despite increasing contact with western society, the indigenous societies of the Bering Straits Region are able to maintain the profoundly important relationships that make up "culture" (DOI 1985a). The foundation for the region's contemporary cultures are deeply rooted in settlement patterns, social organizations, and dynamic subsistence economies (Ellanna 1980, Thomas 1982).

Studies by the Minerals Management Service (DOI 1985a) conclude that the four separate subsistence economies documented by Sherrod (1982) are currently viable in the Bering Straits Region. Sherrod characterized the subsistence economies as follows: small sea mammal hunting; inland hunting and fishing; large sea mammal hunting; and Yukon Delta fishing and small sea mammal hunting.

On cultural, physical, spiritual, and economic levels, present day indigenous communities in the Bering Straits Region depend on subsistence as their ancestors have for generations. Subsistence is the primary and principal activity in the region. Subsistence is the cultural fabric that binds a community/culture together; it is the infrastructure that links the region's communities together in a common bond (MacLean 1985).

Today's subsistence economies are essentially a continuation of centuries-old traditional patterns, social organization, aspirations, and underlying values, including the incorporation of new harvesting techniques to accommodate changing social and physical environments (Ellanna 1983, Magdanz 1983, Robbins and McNabb 1985, Thomas 1980 and 1982, Worl 1982). The persistence of subsistence economies through time suggests that Langdon and Worl's description of the concept that culture defines, orders, and ultimately explains economic manifestation (Langdon and Worl 1981) is empirically valid. The economic viability of subsistence has been documented by Worl (1982), Thomas (1982), and DOI (1982). Worl (1982) showed that from an economic perspective, the movement of subsistence goods is initiated for the principal value derived from the product itself.

Langdon and Worl (1981) characterize a subsistence economy as having the following characteristics:

a. Production, whether from naturally-occurring biological and other resources or from domesticated resources, is primarily for personal or household consumption (production of use values).

b. Distribution is, for the most part, carried out through traditional, noncommercial channels.

c. Consumption of the overwhelming majority of items produced takes place within the household or the community.

d. Resources used are derived from local and regional areas in the vicinity of the community.

e. Production and distribution are not organized to obtain the greatest possible return given available labor and technology but are organized for security and continued existence.

Wolfe (1985) refers to subsistence as Alaska's hidden economy. Contemporary subsistence economies cannot exist without cash (Thomas 1982). An understanding of the importance of subsistence to Alaska's capital economy and social welfare will allow a more balanced approach to planning and development. Such an understanding will, in the long run, mutually enhance the State's subsistence and cash economies rather than promote development at the expense of subsistence (Wolfe 1985, DOI 1982).

Subsistence activities provide a reliable economic base for the region's villages. Research by the Minerals Management Service (DOI 1985a) projected that 50% to 80% of a village's diet is composed of subsistence resources. Wolfe (1985) documented that subsistence resources make substantial contributions of as much as 1,498 pounds per capita to village economies.

The Bureau of Land Management (DOI 1982) used an Institute for Social and Economic Research (ISER) real per capita income growth model to predict a 2.8% increase for the Bering Straits Region for the period 1979-2000. According to BLM, for the following reasons, the model's 2.8% increase in real capita income over a 20 year period is unrealistically high:

a. The economic model averaged income from the region as a whole;

b. There are fewer jobs in the villages than in regional centers. Therefore, there is proportionately less personal income and real per capita income in the villages;

c. Due to varying cultural priorities, language barriers, and education, fewer indigenous residents would have access to jobs in either the villages or the regional centers;

d. Indigenous family sizes are generally larger than non-indigenous families, thereby decreasing the overall effective income per household;

e. Inflation in rural villages increases in geometric proportion to that in regional centers, due primarily to transportation costs; and

f. Rural villages have subsistence as an economic alternative to compensate for inflation. Outside the realm of a capital economy, subsistence could ultimately provide both direct needs and raw materials necessary to produce goods for "commercial sale".

Worl's (1982) work on contemporary subsistence economies indicated that Ray's (1964) postulates on the factors responsible for the historical cultural integrity of the region's indigenous society are valid today. According to Worl (1982), subsistence economies involve three major, interrelated components: production, distribution, and consumption of natural resources.

Subsistence provides the resources necessary to produce food, clothing, shelter, fuel, tools, equipment, arts, ceremonial objects, and crafts. Although this discussion has focused on subsistence from an economic perspective, the importance of subsistence to the religous and social realm of the region's indigenous population cannot be overstated (DOI 1982, Langdon and Worl 1981, Thomas 1982).

Subsistence goes beyond harvesting fish and game for recreational or sport purposes. Subsistence does not occur because of poverty, or under-employment (Worl 1982). Subsistence is a flexible and dynamic system, constantly changing in order to adapt to such variables as resource availability, environmental conditions, needs of the community, awareness of availability of resources, harvest and storage technology, characteristics of harvesters, time of year, methods of preparation, and storage availability (Thomas 1982).

Subsistence is governed by ideas and institutions that are deeply embedded in the culture of indigenous societies. Motives such as prestige and harmonious social relationships rather than material or individual gain are more likely to be the motivating force in subsistence economies (Langdon and Worl 1981). The rationality of decisions in subsistence economies can only be evaluated from the perspective of the cultural milieu from which the decisions are made (Worl 1982).

The basic socioeconomic unit in the region's villages is the extended family (Ellanna 1983, Worl 1982). Extended families are the foundation of a community's cohesiveness and social identity. Integration of extended family members into a cohesive community group provides the foundation upon which the cultures of the region's indigenous societies are built. The extended family is the transmittal vehicle for a community's cultural values and ideologies from one generation to the next (DOI 1982, Worl 1982). It is through the extended family that a sense of individual identity and social order is developed and supported. Regional identity and social order are maintained through reinforcement of kinship, social, and political ties with other communities (Worl 1982).

Extended families and kinship systems are the cornerstone of subsistence economies. The most effective and efficient production and distribution of subsistence goods occurs through adaptation of western technology to the subsistence environment, i.e. rifles, snowmachines, chainsaws, ammunition, boats, motors, gas, freezers, meat grinders, plastic bags, nets, decoys, etc. Cash is needed to procure the more effective and efficient means of production available through western technology (Ellanna 1983, Worl 1982).

Wolfe (1985) feels that the need for cash has resulted in an inseparable inter-relationship between cash and subsistence economies. This relationship is evolving into a new economy he terms a "mixed subsistence-cash economy". Such economies are characterized as being primarily focused on harvesting of subsistence resources by extended families, using efficent small-scale technology. Often highly productive, the goal is directed towards fulfilling the self-limiting needs of one's extended family and kinship network (Ellanna 1983, Wolfe 1985, Worl 1982).

Cultural values and ideologies are based upon a community's special relationship with the land (BLM 1983, Worl 1982). Subsistence is the visible manifestation of that special relationship. Distribution of subsistence goods involves division, allocation, and exchange of goods and services (Worl 1982). Governed by cultural codes, distribution has initial and secondary phases. Participants in the harvesting activities share in the initial distribution. Their sharing with their extended family, community members, members of other communities, and their sharing at cultural ceremonies constitutes the secondary phase (Worl 1982). Exchange occurs when an individual trades or exchanges their share for a particular product or service (Worl 1982).

The Bureau of Land Management (DOI 1982) predicts, based on historical and contemporary economic trends, that subsistence dependency of the region's villages will increase over the next 20 years. It is clear, then, that the continuation of subsistence becomes vital to the economic, physical, and cultural survival of the region's villages.

As the region's Indigenous communities continue to evolve, subsistence will continue to be the most viable option for maintaining their economic, social, and spiritual systems (Worl 1982). The sea, tundra, forests, and anadromous fish streams will continue to be the focus of individual, community, and regional subsistence, economic, and social systems (Thomas 1982, Worl 1982, Ellanna 1983, Wolfe 1985).

Development activities have the potential to affect the production, distribution, and consumption of subsistence resources. The only development impact analysis methodologies that are compatible with the dynamic nature of subsistence economies are those methodologies that utilize a case-by-case analysis approach. A preliminary set of issues that need to be addressed in evaluating impacts of development on subsistence are adapted from Worl's 1982 Paper entitled *A Synopsis of Alaska Native Subsistence Economies and Projected Research Needs*; a listing of these pertinent issues are presented in Table 2-1.

2.3 IMPACTS TO SUBSISTENCE RESOURCES

To insure adequate wildlife populations and subsistence harvests, essential habitats must be maintained in productive condition. Development of the region's mineral resources and potential oil and gas reserves could degrade habitats essential to the maintenance of fish and wildlife populations upon which residents depend. Increased sport hunting and fishing and commercial fishing could compete with subsistence harvests. With proper precautions, resource development could occur with little or no reduction in harvests for most villages. Villages located near developed or developing areas might experience increased competition for subsistence resources. Noise, disturbance, and increased harvests could lower wildlife populations. In the event of oil development, villages dependent on areas affected by the development could experience immediate loss of subsistence resources due to disturbance or contamination. The extent and duration of the loss is dependent on the magnitude of the disturbance/contamination and the socio-economic viability and adaptability of the affected community. Subsistence resources used in the Bering Straits Region and their relative sensitivity to disturbance are presented in Table 2-2.

DOI (1985a) projected that if potential oil deposits in Norton Sound were developed and onshore facilities constructed at Cape Nome, subsistence harvests would decline in the area between Sledge Island and St. Lawrence Island. Villagers most likely to be affected are those living in Diomede, Savoonga, and Gambell. Villages between

TABLE 2-1: SUBSISTENCE RESEARCH ISSUES

1. To what extent is a community's social, economic, and spiritual survival and viability maintained by communal harvesting, distribution, and consumption of subsistence resources.

2. What is the extent and nature of expanded networks of sharing and exchange of subsistence resources.

3. To what extent is a community's autonomy and social existence related to the harvesting, distribution, and consumption of subsistence resources.

4. To what extent does subsistence harvesting, distribution, and consumption accentuate or minimize material, well-being differentials among group members.

5. To what extent does production from a subsistence economy disrupt or endanger subsistence resources.

6. To what extent are traditional subsistence harvesting, distribution, and consumption altered by commercial exchange of subsistence products.

7. To what extent does commercial exchange of subsistence resources modify individual or community standards of living.

8. To what extent does commercial exchange of subsistence resources accentuate or minimize material well-being differentials among group members.

9. To what extent are subsistence resources impacted by commercial exchange for subsistence products.

10. What are the customs and values affecting internal and external production, distribution, and consumption in a community's subsistence and capital economies.

11. What are the intra- and inter-community mechanisms (ceremonial distribution, sharing, partnership, trade, commercial exchange) and extent of circulation of subsistence resources.

12. What is the nature, mechanism, extent, significance, and impact of ceremonial distribution of subsistence resources from an individual, community, and regional perspective.

13. What is the nature, mechanism, extent, significance, and impact of sharing of subsistence resources from an individual, community, and regional perspective.

14. What is the nature, mechanism, extent, significance, and impact of partnerships on subsistence resources from an individual, community, and regional perspective.

15. What is the nature, mechanism, extent, significance, and impact of ceremonial distribution of subsistence resources from an individual, community, and regional perspective.

16. What is the nature, mechanism, extent, significance, and impact of commercial exchange on subsistence resources from an individual, community, and regional perspective.

17. As a result of development, what is the extent of individual and community role alteration and adjustment required for increased participation in a capital economy at the expense of participation in the current subsistence economy.

TABLE 2-1 *continued*

18. As a result of development, what is the range of internal variability in a community's economies, growth stratification, and the effects of such change on the cultural and social organization of the community.

19. As a result of development, what is the extent and nature of differences between men and women in work force participation, the resulting effects on subsistence, and the impacts on the community's social, economic, and spiritual systems.

20. As a result of development, what is the nature, extent, and impacts of inter-community linkages of residents.

21. As a result of development, what is the nature and extent of the relationship between local economic processes and economic processes of state and federal scope.

22. As a result of development, what is the nature, extent, and degree of changes in the customary patterns of harvesting, distributing, and consuming of subsistence resources, due to the presence of increased cash in a community.

23. As a result of an influx of "outsiders" due to development, what is the nature, extent, and degree of impacts to "local communities" social, economic, and spiritual systems.

24. What is the nature, extent, and degree of impact of development on a community's kinship and social organizations, leadership institutions, and politics at family, community, and regional levels.

Source: Adapted from *A synopsis of Alaska Native subsistence economies and projection of research needs* (Wolf 1982).

Nome and Unalakleet would have about a 35% chance of oil contamination in their fishing and marine hunting areas. The effects on village harvest would vary greatly, depending on the size of the spill, weather conditions, season, availability of cleanup equipment, and biological resources present at the time (see Chapter 6). The Department of Interior also stated that onshore impacts and activities and potential conflict and competition between sport and subsistence hunters and fishermen could be significant, particularly during construction which could span seven to ten years. In addition, increased reliance on a cash economy in some villages could result in less sharing which, over time, could reduce community cohesion (DOI 1982).

Without firm proposals for mineral development, accurate predictions of the localized effects of mineral development on subsistence resources and activities is speculative. Mineral development could lead to local reductions in subsistence due to habitat loss or degradation, noise and disturbance, and competition from sport hunters and fishermen. The cumulative effects of large-scale hardrock mining and numerous placer or sand and gravel extraction operations could cause widespread reduction in subsistence resources on the mineral-rich Seward Peninsula, particularly in freshwater and anadromous fish habitats sensitive to water quality degradation. Strict adherence to water quality standards and other prudent environmental safeguards developed on a case-by-case basis could minimize the impacts of extensive mineral development on local subsistence harvests.

Simultaneous, as well as cumulative, oil and gas and mineral development in the same area would increase the probability of adverse impacts to subsistence habitats, populations, and harvest areas. The western Seward Peninsula, particularly the Nome area, has the potential for both types of development. With prudent safeguards, significant alteration or reduction in subsistence harvests could be minimized.

TABLE 2-2: RESOURCES USED IN THE BERING STRAITS REGION AND THEIR RELATIVE SENSITIVITY TO THREE TYPES OF DISTURBANCE[1]

ommon Name	Relative Sensitivity to		
rimary Food and aw Material Sources	Oil Spills[1]	Other Exploration & Development Impacts[1]	Harvest Pressure[2]
hale, Bowhead	Low-Moderate	Low-Moderate	High
alrus, Pacific	Low-Moderate	Low	Moderate
eal, bearded (oogruk)	Low	Low	Low-Moderate
eal, harbor or spotted	Low	Low-Moderate	Low
eal, ringed	Moderate	Moderate-High	Moderate-High
almon, king	Moderate	Low	High
almon, silver	Moderate	Low	High
almon, chum	Moderate	Low	High
almon, pink	Moderate	Low	High
almon, sockeye	Moderate	Low	Low
hitefish, broad	Moderate	Low	Low
hitefish, humpback	Moderate	Low	Low
heefish	Moderate	Low	Low
loose	Very Low	Moderate	High
aribou or reindeer	Very Low	Moderate	High
econdary Food and aw Material Sources			
eal, ribbon	Low	Low-Moderate	Low-Moderate
hale, gray	Low-Moderate	Low-Moderate	Moderate-High
ear, polar	Low	Low-Moderate	Moderate
ear, black	Very Low	Low-Moderate	Moderate
ear, grizzly	Very Low	Low-Moderate	Moderate
eaver	Very Low	Low-Moderate	Moderate
quirrel, Arctic ground	Very Low	Low-Moderate	Moderate
orcupine	Very Low	Low-Moderate	Moderate
lare, snowshoe	Very Low	Low-Moderate	Moderate
uklet, least	Very High	Moderate	Low
uklet, crested	Very High	Moderate	Low
uklet, parakeet	Very High	Moderate	Low
ider (several species)	High-Very High	Moderate	Low-Moderate
ldsquaw	High	Moderate	Low-Moderate
intail	Moderate-Low	Low	Low-Moderate
rant, black	High	Moderate	Moderate-High
oose, snow	Low	Moderate	Moderate
oose, white-fronted	Low	Moderate	Moderate-High
rane, sandhill	Low	Moderate	Moderate-High
urre, common (particularly eggs)	High	Moderate	Low

TABLE 2-2 *continued*

Primary Food and Raw Material Sources			
Murre, thick-billed (particularly eggs)	High	Moderate	Low
Ptarmigan, willow	Very Low	Moderate	Moderate
Ptarmigan, rock	Very Low	Moderate	Moderate
Crab, king	Moderate	Low	Low
Crab, tanner	Moderate	Low	Low
Clams (several species)	High	Low	Low
Blackfish	Low	Low	Low
Char, Arctic	Low	Low	Low
Cod, saffron (tomcod)	Low	Low	Moderate
Flounder, Arctic	Low	Low	Low
Grayling	Low	Moderate	Moderate
Pike, northern	Low	Moderate	Moderate
Cisco, least	Low	Moderate	Moderate
Herring, Pacific	High	Moderate	High
Halibut, Pacific	Low	Low	Low
Smelt	Moderate	Low	Low
Mussels (several species)	High	Low	Low
Sculpin	Low	Low	Low
Burbot	Low	Low	Low
Whitefish	Moderate	Low	Low

1. Assessment of relative population sensitivity to oil spills are generalized.

2. Harvest pressure for birds cannot be reliably assessed by species.

Source: DOI 1982

2.4 ABILITY OF RESOURCES TO SUSTAIN HARVEST DEMANDS

2.4.1 Marine Mammals

At present, most of the region's wildlife populations appear to be thriving. Walrus, a mainstay of Bering Strait villages (Gambell, Savoonga, Diomede), may have reached maximum sustainable numbers given available food sources (Frost 1982). If the walrus population falls drastically, villages dependent on walrus for food and raw mterials for arts and crafts would suffer. Current seal population levels are sufficient to meet subsistence harvest demands in coming years. Bearded seals are the preferred species and are at or near maximum sustainable levels (Klinkhart 1977). However, a localized oil spill or persistent noise and disruption could reduce local harvests of marine mammals. A major tanker spill could mean widespread damage, perhaps reducing harvests rates for many years if prey species were greatly diminshed or contaminated (DOI 1982). Spills or clean-up activities in marine mammal migration routes or feeding areas could alter wildlife distribution and thereby reduce harvest.

Chronic pollution from oil and mining development could gradually reduce productivity of the marine ecosystem, particularly in areas with poor water circulation such as lagoons and some sheltered bays. This could lead to incremental population declines of seals and other subsistence species. Long-term noise and other disturbances affecting essential habitats could cause geographic redistribution of wildlife populations or even gradual population declines (Starr et *al.* 1981; Chapter 6).

Reduction of prey or alteration of migration routes due to oil spills or increased ship traffic could greatly reduce harvests if whale migration routes shifted beyond a reasonable travel distance from local villages. Endangered bowhead whales appear to have a fairly stable population and presumably can sustain present low harvest levels (Dames and Moore 1980). Alaskan experts disagree as to whether bowhead whales, recently estimated at approxnately 3,800 animals, can support long-term subsistence harvest if resource development results in population leclines. This, and the potential for declines in a small population, caused Dames and Moore (1980) to project ı small, gradual decline in bowhead numbers.

ielukha whale populations are adequate to meet current subsistence needs; however, as with bowhead whales, here is concern about the possible adverse effects development might have on belukha populations. Belukha ippear to be highly sensitive to disturbance.

Polar bear harvests vary dramatically from year to year. These animals are primarily taken for their fur, which villagers use to make garments and items for sale. OCS oil development and coastal activities near shoreline denning areas could alter polar bear distribution.

2.4.2 Fish and Shellfish

Many fish and shellfish species experience substantial changes in populations from year to year in response to natural conditions. With the exceptions of king crab, chum salmon in the Nome area, and sockeye salmon, subsistence fish and shellfish populations generally appear stable. According to Dames and Moore (1980), sockeye salmon populations will probably not recover if subsistence demand continues at the present level. Sockeye salmon, limited to the Salmon Lake-Pilgrim River area, have declined despite regulations against commercial catches. Extensive sports fisheries of chum salmon in the Nome area are primarily responsible for the chum decline.

Oil and gas development and mining could reduce fish and shellfish populations, probably in localized areas, or result in a gradual long-term population decline if the marine ecosystem or freshwater drainages are degraded. Activities related to onshore oil facilities and terminal and tanker traffic could jeopardize the viability of localized king crab gathering areas. Dames and Moore (1980) projected that roads and pipelines crossing streams along the southern side of the Seward Peninsula could degrade stream habitat and lead to significant long-term salmon losses and reduced harvest (see Chapter 6). Mining, particularly in-stream sand and gravel extraction and placer mining, have the potential to seriously degrade stream habitat and greatly reduce freshwater and anadromous fish production in the affected stream. Streams subjected to heavy sedimentation could take years to regain their former productivity (Hall and McKay 1983). Widespread placer or in-stream material extraction which does not meet state water quality standards or which directly destroys spawning areas or other important habitats can reduce salmon, char, grayling, and whitefish stocks in the region. Loss of habitat can permanently reduce stream productivity. Local declines in fish populations could affect dependent subsistence, commercial, and recreational harvests.

Herring eggs and larvae, among the most sensitive of all fish life to oil contamination, can suffer major losses from oil spills, chronic pollution, or alteration of spawning areas (e.g., by dredging or other shoreline alteration) (Barton 1978, Starr *et al.* 1981). Subsistence and commercial herring fisheries could also suffer. Crab and tomcod (saffron cod) eggs and larvae float near the surface where they could be killed by oil contamination (Starr *et al.* 1981).

2.4.3 Land Mammals

Terrestrial mammal populations in the region are relatively small compared to the abundance of marine mammals. Up to 30,000 caribou winter east of the Koyuk River on the Seward Peninsula (Anderson, ADF&G, personal communication). Moose browse in major river valleys and uplands throughout the mainland. Maximum sustainable populations occur in several major drainages (Grauvogel, ADF&G, personal communication). According to local residents, the wide-ranging grizzly bear seems to be increasing in numbers.

As the region's human population grows and subsistence and sport hunting intensifies, subsistence hunters may find moose and caribou increasingly scarce (Dames and Moore 1980). The principal concern is an increased demand for the same number of animals. Grizzly bear, though less important for subsistence, could also decline.

Dames and Moore (1980) indicated that increased hunting pressure on moose could gradually lower regional population levels. Any further increase in hunters or improved access afforded by resource development or new settlements (e.g., Pilgrim Springs) could speed up the decline, unless the state and private landowners limit hunting through restricted access and increased enforcement. Influxes of oil field workers, miners, or recreational hunters could worsen the situation. Population declines of moose and other wildlife would generally occur in proportion to increases in human population (Dames and Moore 1980).

2.4.4 Birds

In early spring when few other resources are available, migrating waterfowl provide an essential subsistence food source for most villages. Waterfowl in the fall, seabirds in summer, and eggs in late spring are also important subsisence resources. According to Dames and Moore (1980), subsistence hunters annually harvest 10 percent of the region's ducks and geese. Regional sport hunting is minor by comparison. The region's waterfowl should be able to sustain current levels of harvest (Dames and Moore 1980). Nesting and feeding areas along the Nome road system, such as the stretch between Cape Nome and Solomon, are vulnerable to overhunting and disturbance, particularly if onshore oil facility sites and supporting infrastructure are developed in the vicinity. Such areas could experience increased competition for available resources, and subsistence harvests might decrease as a result. Seabird populations fluctuate with environmental conditions, but barring severe habitat degradation, populations should be more than adequate to meet the subsistence demands for eggs.

Some egg-gathering areas, particularly along the southern side of the Seward Peninsula, could be less productive if noise and disturbance from oil development or offshore dredging reduces nesting success or increases loss of eggs. Waterfowl and seabirds are extremely vulnerable to oil pollution and could suffer significant population declines in affected areas in the event of a major oil spill. Depending upon the location and size of a spill and the subsequent impact to regional bird populations, subsistence harvests could be adversely affected. Affected bird populations could take many years to recover from such a disaster, particularly if oil contaminates prey or coastal wetlands.

Dames and Moore (1980) concluded that a large or medium oil discovery in Norton Sound could result in moderate to severe bird population declines between Cape Nome and Rocky Point, should onshore facilities and pipelines be built in the area. Reduced nesting success along pipeline corridors could decrease Norton Sound's overall waterfowl and seabird populations. Increased activity, particularly noise and other disturbance near nesting areas, and chronic pollution could also cause gradual population declines (Dames and Moore 1980). Abandonment of colonies at Bluff (the Seward Peninsula's largest seabird colony with approximately 90,000 murres) and elsewhere along the northern shore of Norton Sound would result in significant seabird losses.

2.4.5 Vegetation and Timber

Plants and berries constitute a significant portion of the subsistence diet of many households in the region. Loss or contamination of gathering areas could result from an oil spill, mining, construction, or other activities.

Standing timber and driftwood are significant resources to the residents of the region. These resources are used as building materials and as heating fuel. Loss or reduction of gathering areas could result from development activities that block access, remove the resources, or deny use through issuance of exclusive use permits.

Chapter 3: Coastal Habitats

3.1 ISSUES AND CONCERNS

The major issue and concern is the effect of resource development on coastal habitats, and its subsequent impact on subsistence resources.

3.2 HABITAT SENSITIVITY AND VULNERABILITY

The region's coastal habitats support a wide variety of fish and wildlife and other biological resources. Habitat productivity is essential for continuation of subsistence, commercial fishing, reindeer herding, ivory carving, trapping, gathering, and other pursuits which sustain the region's people. Maintenance of productive coastal habitats is vital to the residents of the region. The coastal habitats of the Bering Straits CRSA vary greatly in their sensitivity and vulnerability to disturbance, alteration, and degradation.

Sheltered waters (e.g., lagoons and protected bays) with poor water circulation are sensitive to turbidity and contamination, particularly spills of petroleum or petroleum products. In general, shorelines consisting of exposed rocky headlands, wave-cut platforms, fine-grained sand beaches, and fine sediment tideflats have lower vulnerability to contamination because wave action regularly cleanses them. Exposed, coarse-grained beaches and basalt-boulder beaches have moderate sensitivity to oiling because oil penetrates coarse beach material and clings to rocks, often persisting for years (DOI 1985a). Sheltered rocky shores, eroding peat scarps, sheltered tidal flats, and marshes have high sensitivity to oiling because oil clings to vegetation, rough rock and sediment surfaces, and remains until natural processes break it down over a period of years.

Based on an evaluation of the sensitivity and vulnerability of the Norton Sound coast to oil contamination, coastal marshes, deltas, and tideflats in Norton Bay, particularly at the northern end, would be very difficult to protect from a large oil spill in the area. Inclement weather and high seas can greatly reduce the effectiveness of oil spill containment devices and procedures. Winter spills generally require different techniques and cleanup/containment equipment.

St. Michael Bay has been considered as a site with potential to support onshore oil and gas facilities (Woodward-Clyde 1984). The shoreline from Klikitarik to Point Romanof includes a major herring spawning and commercial fishing area in St. Michael Bay, and Stuart Island canal which supports important waterfowl and shorebirds habitats. These extensive areas would be virtually impossible to protect from the adverse impacts of an oil spill. Tar and other residue along the shoreline could persist for years, particularly in sheltered areas among rocks. Recovery of epifauna and algae communities could take years. Herring eggs and larvae could be destroyed, and birds and their habitats could be fouled.

Following is a discussion of each of the coastal habitats identified in the Alaska Coastal Management Program (ACMP). The Resource Inventory (Volume 1, Coastal Habitats) provides a more detailed description of each coastal habitat and the fish and wildlife which depend on them. The ACMP coastal habitats in the Bering Straits CRSA are identified on Map 7 of Volume 1 (Resource Inventory).

3.2.1 Offshore Areas

The marine waters of the region support salmon, crab, and other species of commercial and subsistence value and may contain oil, gas, and mineral deposits. Local subsistence fishermen who rely heavily on the availability of anadromous fish, depend on the productivity of offshore habitats since salmon, char, and whitefish spend part of their life cycles in coastal and offshore waters where they also comprise an important part of the marine food web. Marine mammals and birds, vital to local subsistence, are also a part of the marine food [illegible] in this rich environment.

The shallow Bering Sea is subject to frequent storms that cause the water column to upwell, suspending an abundance of nutrients which sustain much of the region's marine life. Eelgrass and kelp beds are among the most nutrient-rich offshore environments; they provide essential lifecycle habitats, i.e., spawning substrate for herring.

Petroleum exploration and production bring the potential for oil blowouts, spills, seepage, and toxic pollution which could be harmful to marine life and significantly degrade the marine ecosystem. If impacts are severe enough to reduce the productivity of offshore waters, local subsistence economies and way of life could be subsequently affected. Development and activities associated with petroleum operations also have potential for disturbing bird, marine mammal, and benthic life and disrupting migration patterns and breeding/nesting behavior.

Undersea mining and dredging could harm benthic life; disrupt the food web; disturb waterfowl, sea bird colonies, and walrus and seals in haulout areas; prevent belukha whales from entering estuaries; and induce sediment transport and deposition which could alter the shoreline configuration.

3.2.2 Estuaries

Estuaries, where fresh and salt waters mix (e.g., at river mouths), are very productive habitats. A more detailed description of the distribution and importance of estuaries is provided in Volume 1, Estuaries. Estuaries provide food and cover to pelagic, intertidal, and anadromous fish species. Juvenile salmon feed in estuaries, and as adults, school in estuaries before entering rivers to spawn. Estuaries also support feeding, resting, and staging waterfowl, shorebirds, and some seabirds. Belukha whales also enter estuaries to feed.

The productivity of an estuary is a function of the incoming flow of fresh water, the amount of nutrient load it carries, and the extent of solar penetration. Shallow estuaries tend to be more productive than deeper ones due to the amount of solar radiation available to phytoplankton and its effect on water temperature. Tidal flushing in balance with other physical properties (embayment topography, bottom gradient, and freshwater inflow) is another important factor that contributes to estuary productivity. Though some estuaries are large (e.g., Norton Bay and the Yukon River estuary), others are hardly noticeable, consisting of the mouth of a small stream with a sandbar, hook, or other shoreline feature. Cumulatively, these small estuaries provide a substantial contribution to the productivity of marine ecosystems.

Estuarine productivity can be diminished by pollutants discharged directly into estuarine waters or those which are transported by freshwater or tidal inflow. Pollutants can reduce available oxygen and/or introduce toxic agents. An increase in suspended and settleable sediment load can interfere with solar penetration, smother benthic organisms, and inhibit the gill function of fish. Increases in sediment load can be produced by disturbances within the estuary, by development at other locations along the coastline (sediment transported by longshore drift), and by upstream sediment-producing activities. Freshwater discharges generally carries most pollutants into estuaries.

In the event of oil development in the region, offshore oil spills could, through wind and current transport, reach sensitive estuarine habitats. If oil reaches protected estuaries, it may have long-term deleterious effects, especially if it impacts coastal marsh vegetation (Hayes 1979).

<u>Methods of Minimizing Impacts:</u>

- Encourage issuance of discharge permits that insure pollutant levels will not adversely impact the quality and productivity of estuaries or other dependent uses.

- Encourage cooperative planning for development permits that may take place in drainage basins which discharge into productive estuaries.

3.2.3 Wetlands and Tideflats

Wetlands, marshes, and tideflats commonly occur together along sheltered portions of the coast. Large expanses of tundra wetlands cover much of the region's coast and interior (Volume 1, Map 7). Some of the more important wetlands within the Bering Straits CRSA are described in Volume 3, Appendix A.

Wetlands, considered to be some of the most biologically productive areas on earth, serve as a source of nutrients for freshwater and marine environments and as rich feeding areas. Young salmon and other juvenile fish depend on nutrients from coastal wetlands. Waterfowl and shorebirds prefer wetlands for nesting, rearing, feeding, and staging areas. Many small mammals and larger animals such as bear and moose forage in wetlands. Tideflats contained in intertidal areas seasonally support large populations of shorebirds and waterfowl.

Pollution can degrade water quality in wetlands and intertidal areas by introducing toxins that lower productivity and reduce available oxygen. Oil spills cleanup is more difficult in wetlands than in any other habitat, and can represent a serious threat where oil development occurs. Depending on the magnitude of a spill incident, oil can remain in wetlands and kill vegetation for several years (DOI 1985a). Wildlife and prey populations could decline due to direct long-term contamination, reduced habitat productivity, or reduced nesting success. Bird population losses could be heavy, particularly along the fringes of deltas. Oil can also cling to fine-grained sediments in tideflats for years to contaminate clams and other benthic organisms and species which feed on them (e.g., birds, seals).

Equally as threatening is the vulnerability of wetlands and tideflats to dredge-and-fill operations. Dredging can increase turbidity and sedimentation, decrease oxygen, alter water circulation patterns, and create navigation hazards. Breakwaters, jetties, and other structures extending into the sea can alter circulation patterns, which could in turn affect coastal marshes and tideflats. Significant adverse impacts to wetlands and tideflats could eventually reduce populations of marine fish, mammals, and birds.

<u>Methods of Minimizing Impacts</u>

- Map surface and subsurface drainage systems that supply wetlands to provide baseline information for assessment of potential impacts of development.

- Avoid dredge-and-fill operations in wetlands and tideflats, and avoid alteration of surface drainage patterns.

3.2.4 Barrier Islands and Lagoons

Barrier islands shelter lagoons along much of the region's coast (see Volume 1, Map 7). Generally highly productive, lagoons serve as rearing areas for salmon, herring, and other fish, and as feeding and staging areas for waterfowl and shorebirds.

Relatively poor water circulation make lagoons susceptible to contamination. Barrier islands shelter the lagoons, but oil flowing through the lagoon inlet or breaching the islands during a storm could cause serious damage in the lagoon. Vegetation along the shores of protected lagoons, as in wetlands, can retain oil for long periods. Oil contacting fine-grained barrier islands or beaches would penetrate less deeply into the substrate than if the oil came in contact with medium- to coarse-grained (e.g., sand and gravel) beaches or islands. The natural erosion and deposition processes at work along barrier island beaches and lagoon shorelines could result in oil being buried 50 to 100 cm deep within a few days (Hayes 1979). Removal of oil-contaminated material could considerably alter the beach and possibly lead to significant erosion. Remaining buried oil would be released by natural erosion (e.g., during storms), causing long-term pollution (Hayes 1979). Gravel beaches allow oil to penetrate up to about 45 cm, and new beach material would soon cover it. Natural cleansing of mixed sand and gravel beaches is slow, taking 15 to 20 years (DOI 1985a). Mechanical removal of oil would require removal of all oiled gravel (Hayes 1979).

The islands, spits, and peninsulas encircling and The islands, spits, and peninsulas encircling and sheltering lagoons cannot withstand much alteration without disruption or even destruction of the lagoons. This disturbance can result from removal of parts or all of an island (dredging or excavation), direct filling of channels between islands, creation of new passes by excavation or dredging, or deposition of material resulting from activities that occurred elsewhere along the shoreline. Breakwaters, groins, and similar structures can alter the transport of sediments which build and maintain barrier islands, causing them to erode away.

Methods of Minimizing Impacts

- Design and site development activities and facilities in a manner that avoids the dredging of barrier islands and minimizes activities when fish, waterfowl, and marine mammals are present in lagoons.

3.2.5 High-Energy Coast

High-energy coastlines are those subjected to direct effects of ocean waves and active coastal processes; these habitats are also subjected to storm waves, ice action, and other meteorological events (Volume 1, Map 7). In these areas, some shorelines erode and serve as a source of material for beaches which form when wave action and currents allow material to settle out. This habitat, often consisting of boulders and other coarse material, is favored by seals and walrus. Oil reaching eroding peat scarps, which occur along portions of Norton Bay and near Cape Denbigh, would cling to vegetation forming mats of oiled material. Erosion during high wave conditions could also cause oil to be deposited in sediments. Shore structures erected in these areas could be subject to wave battering, ice damage, flooding, and erosion. Since eroding sections of coast are a sediment source, structures e.g., breakwaters, jetties, causeways or docks) extending beyond the high-water line could interfere with sediment transport along high-energy coasts. Interruption of longshore drift could result in gradual disappearance of beaches and barrier islands. As previously discussed in Section 3.2.4, this could also result in the loss of lagoons which were formed by barrier islands. Shoreline alteration and changes in circulation and longshore drift could also affect highly productive marshes, kelp and eelgrass beds, and tideflats as well as the wildlife and people depending on them. A structure extending far into the sea could alter circulation and longshore drift and force migrating juvenile salmon and other young fish into deeper water where they could be more vulnerable to predators.

Methods of Minimizing Impacts

- Avoid siting structures within the coastal flood zone, along exposed high-energy coasts, or other sensitive habitats.

- Encourage the U.S. Army Corps of Engineers to produce thorough and accurate coastal flood hazard information for all of the region's coastal communities.

3.2.6 Rocky Islands and Sea Cliffs

Rocky islands provide essential haulout areas for seals, sea lions, and walrus; seacliffs also serve as nesting locations for millions of sea birds in the Bering Straits CRSA (Volume 1, Map 9). Marine mammals are an essential food source for several villages, and a preferred food source for all coastal village residents. Seabirds and their eggs are also used extensively in some communities. Development near rookeries and haulout areas can adversely affect these areas. Adverse impacts could include noise and wave action from marine vessels serving villages or oil or mining facilities. Noise and disturbance could also result from drilling rigs or dredges located too close to haulout areas and seacliffs. Increases in the number of people working and visiting the region could heighten human disturbance, vandalism to bird nests, and harassment of marine mammals as well as increase sport and subsistence harvests.

3.2.7 Rivers, Lakes, and Streams

Much of the subsistence way of life depends on freshwater drainages, including tundra ponds, lakes, streams, and rivers (Volume I, Map 7). Some streams also contain gold and mineral deposits and several support placer mining operations. Tundra ponds are a major source of nutrients that find their way into wetlands and intertidal areas. Streams and rivers support important spawning, rearing, feeding, and overwintering habitats for anadromous (Map 3-1) and resident fish and provide trapping, recreational, and subsistence opportunities. In addition to supporting waterfowl, these water bodies also sustain small furbearing mammals, some of which are of subsistence and commercial value. The productivity of these streams is sensitive to pollution, stream obstructions, and interference with surface drainage. Alteration of streamflow and instream gravel extraction, placer mining, or stream crossings that damage spawning, rearing, or feeding areas could drastically reduce stream productivity and dependent fish and wildlife populations. Compaction or removal of snow cover (which keeps the water from freezing deeper) or breaking through the ice when attempting to transport vehicles across streams during the winter can also damage sensitive habitats.

Stream channel alterations can be caused by diverting streams or straightening channels for flood control, mining, and pipeline or road construction. These activities can destroy habitats, lower productivity, and increase stream velocity. Gravel extraction and placer mining often widen stream channels, creating extensive shallow water areas while reducing the occurrence of natural pool and riffle areas. Conversely, constricting a stream channel can increases stream velocity which alters stream hydrology, often inducing streambank erosion.

<u>Methods of Minimizing Impacts</u>

- Map drainages of subbasins subject to major development.
- Design and site development activities and facilities in a manner that avoids untreated discharges to rivers, lakes, and streams.
- Avoid alteration of natural drainage patterns, particularly those which are important to wetlands, lagoons, and other productive habitats.
- Establish setback requirements near lakes, ponds, and anadromous fish streams for developments which are not water-dependent.
- Avoid locating pipelines adjacent to streams or in important riparian habitats.
- Encourage use of state-of-the-art technology for pipelines that must cross waterbodies.
- Route roads and pipelines in a manner that avoids alteration to stream hydrology.

3.2.8 Upland Habitats

Upland habitats support a variety of land mammals and birds (Volume 1, Map 7). Essential habitats include winter ranges for moose, caribou and reindeer, bird-nesting areas, and reindeer fawning areas. Cumulative degradation, alteration, or loss of these habitats can displace or reduce wildlife populations.

The alteration of upland habitats during development activities may be site specific, such as a facility location or a mining site, or it could be linear such as a roadway, pipeline, transmission line, or other type of transportation corridor. In addition to direct loss of habitat, thermal and hydraulic erosion and runoff from borrow sites, mining operations, or other development facilities could enter drainages and affect downstream aquatic habitats.

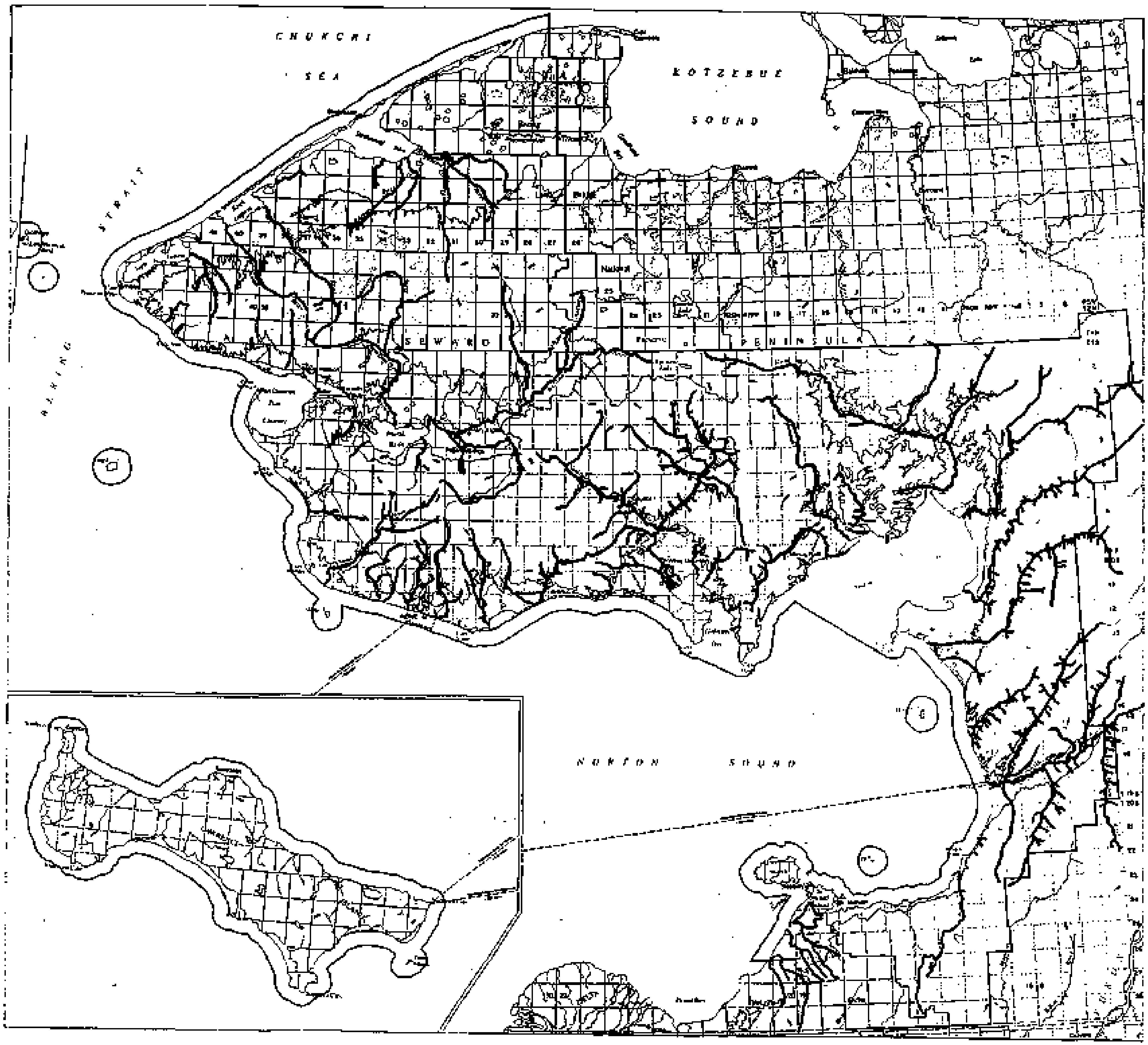
With oil, mining, and other development potentially bringing more people into the Bering Straits CRSA, increased competition among sport and subsistence hunters and fishermen could place additional pressure on the upland wildlife species.

Methods of Minimizing Impacts

- Train local residents of the Bering Straits CRSA in oil spill cleanup methods and locate appropriate equipment in the region for quick response.
- Educate and sensitize new residents and visitors to the region on the sensitivity and importance of coastal habitats.

The following methods of minimizing impacts are appropriate for consideration in all coastal habitats of the Bering Straits CRSA.

- Equip vehicles and construction equipment with appropriate emission control devices.
- Equip power generation and stationary processing facilities with appropriate pollution contol devices.
- Avoid development activities in areas with high sensitivity to alteration or high productivity.
- Encourage use of state-of-the-art technology for blowout prevention and avoid oil development in areas of high risk blowout and oil leakage.
- Avoid undersea mining and dredging that damages the marine ecosystem, creates a hardship on local residents, interferes with commercial fishing, or interferes with subsistence use.



Bering Straits CRSA

Anadromous Fish Distribution

SOURCE: ADF&G Anadromous Fish Stream Catalogue, ADF&G Regional Habitat Management Guides, Bering Straits CRSA Residents

Map 3-1
ANADROMOUS FISH DISTRIBUTION

Chapter 4: Reindeer Herding

4.1 ISSUES AND CONCERNS

Major issues and concerns are:

- maintenance of critical reindeer habitats (e.g., wintering and fawning areas) and corridors connecting these areas;
- potential conflicts with resource development;
- expansion of markets for reindeer meat and by-products; and,
- conflicts with caribou and birds.

4.2 ESSENTIAL REINDEER HABITATS

Reindeer, one of the two domestic animals capable of grazing on tundra plants and surviving the region's long, cold winters (musk-ox have also been domesticated), are a vital source of meat and income for the region. Each of the region's 13 herds has a designated grazing allotment (Map 4-1). The U.S. Soil Conservation Service (SCS) has identified lichen-covered areas which, if snow cover is shallow enough, constitute prime wintering habitat. These overwintering grounds are essential to the survival and growth of reindeer. Unless grazing ranges are rotated each year to alternate areas, reindeer can easily overgraze wintering habitats.

Development activities within the Bering Straits Region can be compatible with reindeer herding as long as accessible and acceptable alternative wintering areas are available. However, development could adversely affect the reindeer industry if important wintering areas are altered or otherwise made unavailable. A more detailed discussion of reindeer habitats is presented in Volume 1, Land Mammals - Reindeer.

Reindeer usually return year after year to traditional fawning (calving) areas (Volume 1, Map 10). These fawning areas provide forage for hungry and weakened reindeer and allow a clear view of potential predators. Like wintering grounds, fawning areas are critical to the survival, growth, and health of reindeer herds. Development activities and facilities could block corridors used by reindeer and their herders to reach fawning areas and summer coastal feeding areas. Based on studies of caribou, females with fawns seem to avoid heavily-traveled roads and pipelines corridors (Cameron et *al.* 1983). Reindeer can be sensitive to noise and disturbance during the fawning period. Activities which impede or significantly delay occupation of fawning grounds could result in significant mortality of weak females and newborn fawns.

4.3 CONFLICTS WITH OTHER WILDLIFE

Reindeer and caribou are very closely related and readily interbreed. Most, if not all, caribou herds in the region include wild reindeer and reindeer-caribou offspring. Herders in the adjoining NANA region to the north have lost hundreds of unattended reindeer to migrating caribou. Increasing numbers of caribou from the Arctic herd have been wintering east of the Koyuk River on the Seward Peninsula. ADF&G estimated that about 30,000 animals occupied the area in the winter of 1983-1984 (Anderson, ADF&G, personal communication). If wild caribou continue to winter on the Peninsula and particularly if they utilize habitats further to the west, reindeer herders can expect to lose animals from their herds. As caribou populations increase, they may also compete with reindeer for preferred wintering areas.

The U.S. Fish and Wildlife Service is currently studying the relationship of reindeer and musk-ox on Nunivak Island, and this could influence wildlife management in the Bering Straits region. Reindeer and other large land mammals that graze in bird nesting areas can trample eggs and thereby reduce bird survival, particularly in high density nesting habitats for waterfowl. The Reindeer Herders' Association feels more studies are necessary in order to determine the effects of reindeer grazing in bird nesting areas.

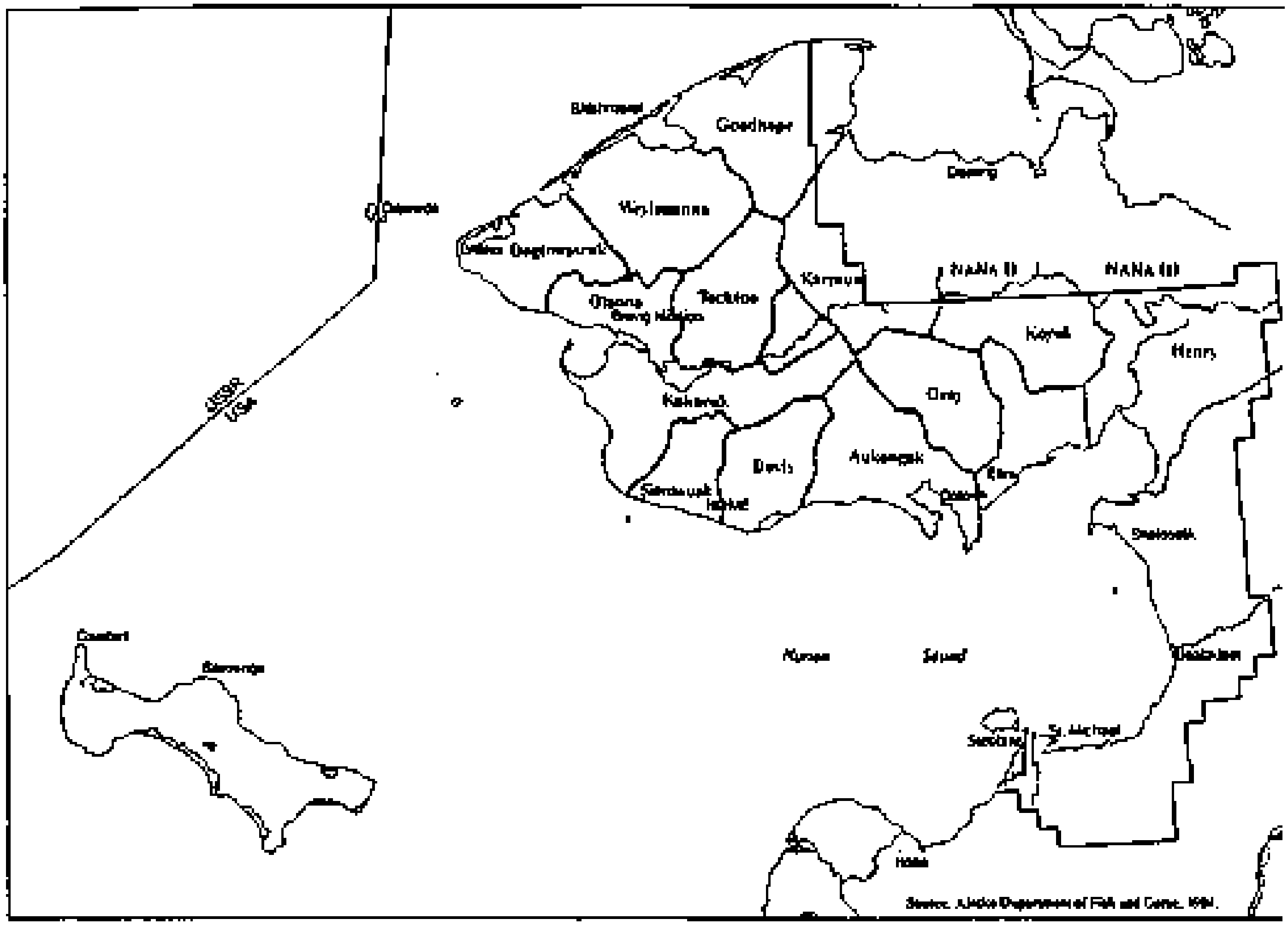
4.4 EXPANDING MARKETS FOR REINDEER

The vast majority of reindeer meat produced in the region is consumed there. Some herders sell excess meat to Alaska Sausage, Inc., in Anchorage and a small quantity of meat goes to the "Lower 48". To market meat outside the region, it must be butchered, processed, and inspected at an approved slaughterhouse. The region's only slaughterhouse is located in Nome. Most reindeer meat consumed within the region and elsewhere in Alaska is butchered in the field. Aside from the slaughterhouse and inspecton requirements, meat sales are limited by other factors.

To handle reindeer meat, distributors and retailers need a dependable, sufficient, and economical meat supply. An Alaska Sausage, Inc., representative noted that each year their firm receives requests from out-of-state dealers for about 50,000 pounds of reindeer meat which they do not attempt to fill because of the often undependable and irregular supply. Major state and national markets are largely inaccessible due to a currently undependable supply of reindeer meat. Smaller outlets, such as restaurants catering to tourists, have expressed an interest in becoming a significant market.

The market for reindeer antlers, though lucrative compared to the meat market (about $23 per pound retail, compared to $1.25 per pound wholesale), is very unstable. In recent years, Asian markets have been flooded with preferred antlers from New Zealand and Russia. An increase in antler production by other countries, or a decrease in the Asian demand could replace or devalue Alaska antlers. Buyers purchase antlers in the region, process them in San Francisco and elsewhere, and sell them to distributors. By the time customers purchase processed antler (as powder or dried wafers), the price has increased by a magnitude of 100.

Map 4-1
REINDEER GRAZING ALLOTMENTS



Chapter 5: Cultural and Historic Resources

5.1 ISSUES AND CONCERNS

Major issues and concerns are:

- the effects of increased development on historic sites, and
- the indiscriminate removal and sale of artifacts.

5.2 PREHISTORY

During the last ice age a vast landmass known as the Bering Land Bridge connected Asia and America. The Bering Land Bridge was a 1,000 mile wide subcontinent, exposed for several thousands of years when sea level was lowered because water was trapped on land in the form of mountain and continental glaciers. Archaeologists believe that 10,000 to 15,000 years ago, though possibly earlier, northern Asians crossed the land bridge to Alaska and moved north and south along the coastline and inland along the river systems (Hooks et *al.* 1983). Many archaeologists believe that people have been in North America at least 20,000 years; but, as yet no one has been able to find conclusive evidence that people occupied the Alaskan Arctic prior to about 11,000 years ago.

The region's indigenous cultures (Inuit) are part of ancient cultures that have survived through skillful use of natural resources and adaptability to change. Evidence of this comes from several major archaeological sites within the Bering Straits Coastal Resources Service Area and elsewhere in northwest Alaska, including: Point Barrow, Point Hope, Cape Krusenstern, Cape Prince of Wales, Onion Portage, Kugzruk, Kurigitavik, Cape Nome, Unalakleet, Iyatayet and nearby Gungnuk at Cape Denbigh, and St.Lawrence and the nearby Punuk Islands. The known prehistory of northwestern Alaska represents five successive periods, which can be differentiated from one another on the basis of changes in tool styles, tool inventory, and settlement pattern. These periods are: full-time tundra hunting, from earlier than 9000 B.C. to 6000 B.C.; adaptation to taiga (mixed spruce-birch forest) - tundra hunting and fishing, from 6000 B.C. to 2200 B.C.; development of seasonal and year-round coastal hunting and fishing, from 2200 B.C. to A.D. 500; prehistoric Eskimo culture, from A.D. 500 to 1778; and historic Eskimo culture from 1778 to the present (Anderson 1984). Evidence for coastal hunting and fishing earlier than about 2300 years ago may now be submerged under the ocean, which was once much lower. The ocean rose to its present level when a post ice-age warming trend melted glaciers and flooded the Bering land bridge.

During the period of adaptation to taiga-tundra hunting and fishing, the ocean had risen to nearly its present level. This was also the time when spruce forests began to be present over much of interior northwest Alaska. More permanent settlements were established during this period, and squarish semi-subterranean houses (sod igloos with no entrance tunnel) were constructed as well as round and oval skin-covered, willow-frame tents. Stone tools characteristic of the Northern Archaic tradition that have been found in these structures include: arrowheads, skin scrapers, net sinkers, spearpoints, and knives.

Between 4,500 and 4,200 years ago, sea level stabilized at its present level. This time marked the emergence of the Arctic Small Tool tradition, characterized by tiny wood, bone and skin working tools, including spear heads, arrowheads, skin scrapers, gravers, adzes and net sinkers. The earliest of the Arctic Small Tool tradition cultures was the Denbigh culture, first discovered in 1948 at Cape Denbigh on Norton Sound. Houses from this culture changed from squarish floor plans to more rounded plans, and for the first time there is evidence that houses had distinct activity areas for sleeping, cooking, and manufacturing. Settlements apparently consisted of only one or two houses.

During the 16th century B.C., the Denbigh culture underwent a series of changes and emerged as a new complex called Choris, named after a site on the Choris Peninsula. Many Choris tools were similar to Denbigh tools, but were larger and less carefully made. Differences in the two cultures are that Denbigh people manufactured microblades (tiny razor-blade like stone implements) whereas the Choris people did not, and the Choris people used pottery. Regional diversity becomes apparent during Choris times, with inland groups depending more on caribou and coastal groups exploiting marine mammals, particularly seals, and fish. Choris houses were large oval affairs; at the coastal Choris site there were three of these houses (one 42 feet long), only one of which had a central hearth. The distribution of men's tools in the larger structure and women's tools in the smaller structures is similar to a later Eskimo settlement pattern which have one or more kazgis.

Norton culture, the youngest within the Arctic Small Tool tradition, has many similarities and some significant differences with Choris culture. Aside from minor stylistic differences in tool forms and an increased use of ground slate tools, Norton differs markedly from Choris in settlement pattern. Norton winter houses usually have long entrance tunnels (although some at Safety Sound and Unalakleet lack tunnels) attached to a deep square living areas. South of Bering Strait, Norton winter settlements consisted of several houses, while north of the Strait these settlements usually consisted of isolated winter houses. This contrast in settlement pattern may be related to differences in the availability of salmon, which are not available in large numbers north of Bering Strait (Lutz 1982).

Prehistoric cultures are those which can be linked technologically directly with modern cultures. The earliest of these cultures, the Birnirk culture, used ground slate weapon heads and tools, chipped chert implements, multiple-spurred harpoon heads with single barbs and opposing chert side-blade insets, thick-walled clay lamps and cooking pots, and a variety of hunting and fishing implements in styles that remained unchanged until the 19th century. Birnirk people at Pt. Barrow hunted whales and used houses similar to later Eskimo styles (Ford 1959). Birnirk settlements have also been found at Cape Krusenstern (Anderson 1984), Safety Sound (Bockstoce 1979), and at the Kurigalivik midden at Cape Prince of Wales, where it was first radiocarbon dated (Collins 1937). Birnirk culture seems to have evolved from the Northern Maritime tradition (Okvik, Old Bering Sea, and Punuk cultures) of St. Lawrence Island. No inland Birnirk sites have been found; and interior inland sites from this time period are related to the Northern Archaic tradition, generally thought to represent an early Indian culture.

Around A.D. 1000 the Western Thule culture developed in Northwest Alaska. Western Thule culture reflects a broadening of the economic base to include increased emphasis on whaling at the coast and caribou hunting at inland areas. There was great diversity in settlement pattern, and each major community adopted its own unique style. Coastal settlements in general were large, often with several semi-subterranean houses with long entrance tunnels.

It was during the Western Thule phase that the Inuit expanded along river systems into the interior Arctic woodlands, where fishing with nets increased in importance. Interior Inuit tundra settlements (from 30 to 50 houses and near large lakes) increased in number beginning in the 17th century (Irving 1962, Hall 1971). As Western Thule culture evolved regional variation became more pronounced, yet a common underlying culture continued to develop, finally becoming Historic Eskimo culture with the advent of commercial whaling and increased trade in western goods.

5.3 TRADITIONAL TRIBAL ORGANIZATION

Indigenous cultures in the Norton Sound area spoke two distinct languages (as do their descendants): Inupiaq and Yupik. Moreover, residents of each island, river drainage, and coastal settlement spoke subdialects that differed slightly from that of adjacent groups. Inhabitants from Shismaref to Unalakleet, including King and Little Diomede islands, were Inupiat, and inhabitants south of Unalakleet, including St. Lawrence Island, were Yuit (Hooks et al. 1983). Inupiat speak two dialects of Inupiaq, Central Bering Strait (including the Igloo/Kauwerak and Wales/Kingikmiut subdialects) and Malemiut. St. Lawrence Islanders spoke Siberian Yupik, and people residing in the St. Michael Island area spoke Central Yupik.

During the mid-to late 1800's the Malemiut shifted from Kotzebue Sound to eastern and southern Norton Sound after Malemiut fur-trading expeditions to the Yukon resulted in Malemiut settlements along the Sound. This left groups of Inupiaq speakers within communities of Unalit Yupik speakers. It was not uncommon for villagers engaged in trading or living near linguistic boundaries to learn two or more languages. Some current Unalakleet residents speak three Inuit dialects. Today, Siberian Yuit reside on St. Lawrence Island, mainland Yuit generally inhabit the area south of Unalakleet, and Inupiat inhabit the area between Shishmaref and Unalakleet, and including Little Diomede and King Islands. Elim residents speak Unalit, a Yupik language. In the late nineteenth century the Inupiat boundary was smaller and extended farther north and west that it does today.

The Inupiat and Yuit of the Bering Straits Region traditionally consisted of 21 groups of cultural, linguistic, and geographic differences). These societies (Burch 1978) or tribes (Ray 1967, 1975) usually comprised one large permanent village surrounded by several smaller villages and campsites within a 20 to 30-mile radius which traded and interacted with each other. Territory in the vicinity of the village or campsite was used by village clusters for hunting and fishing, and groups respected each other's territorial boundaries (Ellanna 1980). Settlement patterns were (and still are) linked closely to subsistence patterns. Most villages were inhabited in winter, but in summer and fall people moved to fish camps, picked berries, traded, and hunted moose, caribou, and other inland game.

The region's residents established extensive trading networks to obtain food, raw materials, and goods not available in their areas. Products from Siberia, such as iron, tea, and tobacco, entered the trading network well before Russians sailed to the region and established trading posts. Trading (e.g., whale or seal for caribou) allowed villages to focus their efforts on those resources that could be harvested in greatest quantities with least effort. It also enabled the region's people to establish relatively large, semi-permanent villages in locations which probably could not have been sustained with only local resources.

This specialization led to development of more sophisticated and efficient harvesting techniques (Kawerak 1981). Coastal erosion, changing river courses, flooding, landslides, changing animal migration patterns, and disease commonly caused abandonment and relocation of villages.

Indigenous cultures north and south of Norton Sound differed fundamentally in house construction, clothing, hunting technology, art, and ceremonial traditions (Hooks et *al.* 1983). Most villages, however, had a kazgi (also called qasgit or qaagiq), a men's house that was used for ceremonies and to accommodate visitors. Kazgis were centers where men worked and exchanged knowledge and served as a focus for local *umialik* leadership (Burch 1978). Women usually entered only to bring food or to participate in community ceremonies or trading. Wales had four kazgis, King Island had two or three, Little Diomede and Shishmaref each had two, and nine villages had one. Other villages may also have had kazgis, although those on St. Lawrence apparently did not (Ray 1964).

The region's indigenous cultures had distinct subsistence patterns which generally persist today. Though relatively little is known about early subsistence use, it appears that about 1000 A.D. some coastal villages began using whale and walrus as primary food sources and seal, fish, waterfowl, and eggs (which had been primary food sources) as secondary sources. Hunters used umiat (skin boats) with large crews to hunt large marine mammals. St. Lawrence Islanders continue to use umiat. Residents of Little Diomede, Wales, Cape Nome, and King, Sledge, and St. Lawrence Islands used whales as well as seals and walrus. Kawerak villages and villages on the north-central Seward Peninsula relied on caribou, supplementing it with fish, birds, plants, seals, and belukha whales. Residents of Golovin, Teller, and Shishmaref practiced the small marine mammal pattern, relying mostly on seals, belukhas, fish, and to a lesser extent caribou and other inland game. Unalakleet, Stebbins, and St. Michael also relied on seals and inland game but depended on salmon and other fish for the bulk of their diet (Ellanna 1980).

The region's indigenous cultures have constantly changed in response to environmental conditions and cultural influences. They have withstood major disruption and change because of the great value put on initiative, adaptability, intertribal tranquility, and interpersonal relations. Seasonal mobility, variety of food resources, and alternative subsistence patterns also were important to the success of the subsistence way of life (Ray 1964).

5.4 HISTORY

5.4.1 European Contact

Russian and European exploration in the 1700's rapidly accelerated indigenous cultures' contact with other cultures and began a series of events that gradually altered the villagers' way of life. Russian explorer Vitus Bering sailed through Bering Strait as early as 1728, naming St. Lawrence and Big Diomede Islands on this journey. Although he had no contact with local residents, this first Russian voyage to Alaska provided information on the region and prompted further exploration. In 1732 another group of Russian explorers (lead by Gvozdez and Fedorov) sailed into the area and collected tribute on St. Lawrence Island. Bering's second voyage to the Gulf of Alaska in 1741 marked the beginning of Russian fur trading in Alaska, although traders were not active in the Norton Sound area until the 1820's and 1830's. Russian navigators, such as Daurkin in 1765 and Kobelev in 1779, continued to explore and map the region (Ray 1975).

James Cook, the celebrated British explorer, sailed through Bering Strait in 1778, naming Sledge and King Islands and Cape Prince of Wales. He traded knives for salmon in the vicinity of Elim and Shaktoolik and found that the residents were already familiar with European goods, which they had obtained through trade with their Sibrian cousins (Ellanna 1980). In 1791 the famous Russian expedition under the command of the Englishman Joseph Billings reached St. Lawrence Island and Bering Strait. At Cape Rodney (across from Sledge Island) Billings exchanged beads, knives, and other metal implements for local goods. In 1816 Russia commissioned Otto von Kotzebue to explore and trade in the region. Von Kotzebue stopped at several villages along the mainland coast and on St. Lawrence Island. In the early 1820's Russia sent several more expeditions to the region. In 1828 Frederick W. Beechey of the Royal British Navy visited Wales.

In 1833 Russians established the region's first non-Native settlement, St. Michael Redoubt, to expand their trade in western Alaska and into the Interior via the Yukon River. Despite early successes in expanding its presence along the lower Yukon during 1830's and 1840's, the Russian-American Company's influence gradually eroded after 1850. In 1867, soon after the U.S. purchased Alaska, the Alaska Commercial Company bought the trading post at St. Michael. The post continued to be a major trading center and later served as a staging area for mining in the region and the Interior (via the Yukon River). Trading centers attracted local inhabitants and intensified their dependency on foreign goods. Re-settlement to trading centers and use of European technology often conflicted with the traditional subsistence way of life and was resisted by many villagers for this reason.

The latter half of the nineteenth century brought commercial whaling, reindeer herding, mineral exploration, commercial fishing, and missionaries to the region. Between 1848, and 1885, nearly 3,000 American whaling ships carrying approximately 80,000 men passed through Bering Strait (Ellanna 1980). The decreasing market for whale oil and baleen and depletion of whales reduced whaling activity. Though short lived, commercial whaling introduced the concept of wage labor to the region's indigenous cultures (Hooks et al. 1983).

Increased intensity and efficiency of hunting whale, walrus (sought for ivory and hides), and caribou (a preferred meat source) led to a dramatic reduction of the number of these animals in the region. When caribou populations decreased in the 1870's and 1880's, most villagers moved to the coast where subsistence resources were available, and many inland villages disappeared.

In 1884 the U. S. government passed the First Organic Act, providing for government in Alaska and appropriating 25,000 dollars for education. Sheldon Jackson, who served as General Agent for Education in Alaska, hired missionary teachers from various church groups to establish village schools. This approach created a patchwork of religions in the region which still exists today. The Swedish Evangelical Covenant Church located in Unalakleet and Golovnin Bay, the Congregational Church in Wales, the Presbyterians in Gambell and Savoonga, the Norwegian Evangelical Lutheran Church in Shishmaref, and the Roman Catholic Church located in Diomede, King Island, and Pilgrim Hot Springs. The Russian Orthodox Church in St. Michael established a formal school in 1886. By the turn of the century St. Michael also had informal Episcopal and Catholic schools (Ellanna 1980).

Formal education did not achieve the goal of assimilating indigenous cultures into the Euro-American culture. In addition to language barriers, conflicts arose between indigenous cultural systems and the strict educational process of western society. Pupils were accustomed to hunting and fishing at any time of day or night and to prolonged travel. Youngsters also participated in ceremonial activities which often took several days or even weeks to complete. Consequently, school attendance was irregular.

Eventually, authorities established boarding schools in an attempt to overcome these conflicts; however, removing children from the day-to-day activities of the community further disrupted traditional patterns (Hook et al. 1983).

Sheldon Jackson promoted the introduction of reindeer to the Seward Peninsula to supplement declining subsistence resources. In 1892 the federal government appropriated money to purchase 1,280 reindeer from Siberia and to open a public school in Port Clarence to teach reindeer herding. Reindeer were initially given to missionaries, but the Lomen Brothers, two Nome entrepreneurs, soon dominated the reindeer industry, selling hundreds of thousands of pounds of meat in Alaska and "Outside" until the market faltered in 1920's and 1930's. It wasn't until 1939, when the government instituted a policy of allowing only Alaskan Natives to own reindeer, that local residents owned a substantial portion of the reindeer in the region.

After a whaler reported seeing silver ore in Golovnin Bay in the late 1870's, miners began converging there. Soon miners also found gold in Fish River and Ophir Creek. In the late 1800's Omilak Silver Mine and Fish River Mining District were organized. In 1898 former Western Union Telegraph employees discovered gold in Anvil Creek near Nome. As the word of gold spread, thousands of people were attracted to the area, and several settlements were established, including Council City in 1898 and Anvil City (present-day Nome) in 1899. About the same time, settlements sprang up at Teller and Solomon. During the three months of summer in 1899, Nome's population gained about 3,000 people. In 1900 miners discovered beach gold deposits at Nome, and another 15,000 people flocked to the area. Although indigenous inhabitants generally did little mining, some provided guide services and transportation via sled dogs, reindeer, and skin boats. Those with cash benefited from the first large influx of commodities into the region. Exploration continued for minerals besides gold, but after miners depleted known deposits, mining slacked off. By 1910 few miners remained in the region.

This major gold mining era introduced non-native communities into the region and strengthened the concept of a cash economy. It also did more than any other period to disrupt and change the Native way of life. The national Register of Historic Places lists several sites and building from this era, including Discovery Saloon in Nome, the Carrie McLain home, Lindbloom Placer Claim, Cape Nome Roadhouse, and Solomon Roadhouse.

Between the mid-1800's and the early 1900's, smallpox, diptheria, and influenza epidemics killed thousands of people in the region. Hundreds of indigenous residents south of Shishmaref and north of St. Michael died from the 1918 influenza epidemic. Whole communities collapsed because sick residents were unable to go out and get food. Shishmaref and points north were spared the ravages of this epidemic because Shishmaref residents would not allow people to enter the village. Epidemics accelerated the move to regional centers, as survivors abandoned their devastated villages and moved to larger settlements.

Commercial fishing for herring and salmon in the Norton Sound area began in the early 1900's. Both continue as important economic activities. In 1917 the Arctic Fish Company first caught salmon in Golovnin Bay and salted them for shipment to markets Outside. In 1906 fishermen took herring in Grantley Harbor and in 1909 from Golovnin Bay. Many early commercial fishermen came from outside the region (e.g., Scandinavia). After a strong beginning, commercial herring fishing ceased in the early 1940's and did not resume until Japanese began fishing in 1963. Local residents only began fishing commercially in the last two decades. In the 1960's the Alaska Department of Fish and Game opened the Shaktoolik, Unalakleet, Moses Point, Golovnin Bay, and Norton Bay subdistricts to commercial fishing. The fishing industry grew slowly, but today, commercial salmon and herring fishing account for most of the cash income for several Norton Sound villages.

5.4.2 World War II to Present

World War II brought more development to the region, especially to St. Lawrence Island, Unalakleet, and Nome, which served as military centers. Nome was the point of departure for Lend-lease airplanes flown to Andyr, Russia. The Eskimo Scouts (also called the Tundra Army) formed in 1942. The purpose of this locally manned, unpaid force was to monitor the remote coastline for enemy activity and, if needed, defend villages. Wartime activity brought some benefits to the region. For example, construction of airfields and roads enabled increased travel in the region, and establishment of military hospitals reduced infant mortality and increased the average life span (Hooks *et al.* 1983). Trade and employment opportunities attracted villagers to military centers (especially Nome) through 1945. These people acquired new skills and reliance on cash. They also found speaking and reading English increasingly necessary.

The Alaska Native Claims Settlement Act (ANCSA), passed in 1971, was a major milestone in the region's evolution. It brought about a restructuring of economic and political systems and created Native corporations with large landholdings and financial resources. It also gave the region's residents some measure of control over many traditional areas that were integral to the stability of the region's subsistence economy.

In the last several years, state oil revenues have enabled substantial expansion of public facilities and sevices in the region's villages. The possibilities of oil and gas or renewed large-scale mineral development could bring about further dramatic changes.

The region's people have adapted to environmental and cultural influences over the centuries, but traditional values, customs, and the way of life have persisted. Aided by modern vehicles, boats, and equipment, subsistence remains the foundation of the indigenous cultures and accounts for most households protein consumption (Ellanna 1980). Although indigenous inhabitants increasingly depend on cash and readily accept many facets of the non-Native lifestyle, they continue to believe that long-term survival depends on their knowledge of the natural environment. Many Inuit think that visitors who come to the region to fish, hunt, take pictures, hike, and enjoy the natural beauty of the area come as "observers". They perceive themselves, however, as an integral part of the environment (Hooks et *al.* 1983).

5.5 CULTURAL SITES

Remnants of the past, such as artifacts, ancient villages, and ceremonial sites, may be found throughout the region (Map 5-1). Some former fish camps and villages scattered along the coast lie below or near existing ones. Some sites have been revealed by shoreline erosion, and others have been discovered during construction projects. In addition to these archaeological sites, numerous historic places, buildings, and antique machinery dating from the gold rush era dot the old gold fields and gold-rush towns such as Council and Solomon.

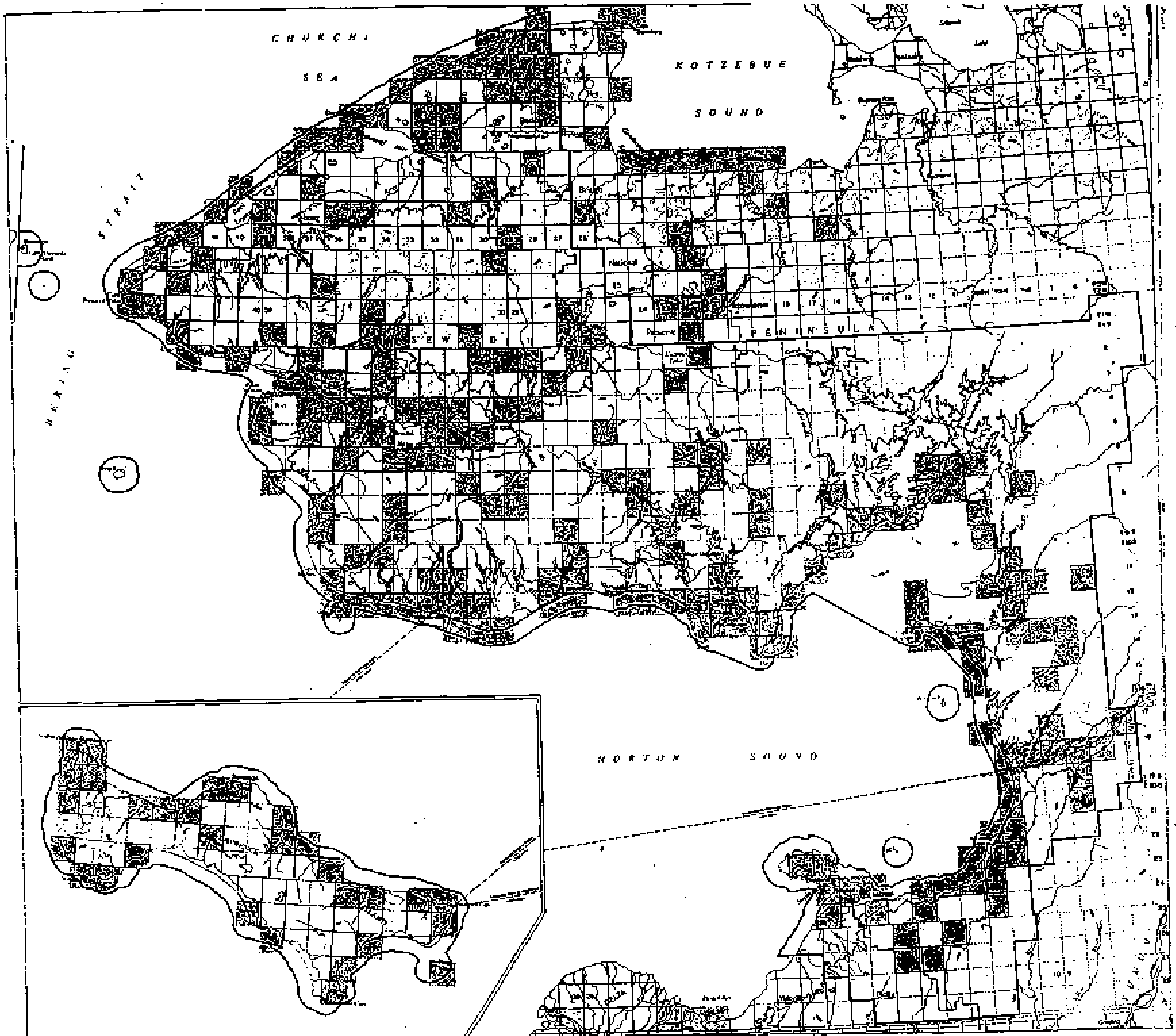
Native and Western cultures view the importance of sites from different perspectives. Rather than seeing land in Western terms of economic, historic, or recreational value, indigenous cultures view the landscape as full of sites significant in a variety of ways. Historic sites may be of value because of the artifacts or relics they contain, events that occurred there, or spiritual or ceremonial significance (such as shaman burial sites). The value of a particular site may not be obvious, but may hold tremendous significance for local people. Alteration of such sites may entail historical loss as well as threat of supernatural retribution (USGS 1979). The meaning of each site is expanded through oral traditions and historical knowledge. Old villages, campsites, and landmarks may have supernatural meanings that affect their current use.

Some sites of importance to the indigenous cultures may have archaeological value, but others may not. Many sites do not have tangible remains or definite boundaries. Because of this, visitors may be totally unaware that they are violating a sacred site. As the region becomes more accessible as a result of petroleum, mining, tourism, recreation or other major economic development, historical sites are more likely to be violated. It is not uncommon for new people coming into the area who are either unaware or insensitive to a site's spiritual significance, to illegally dig and remove artifacts, particularly if the price of ivory artifacts remains high. Development might unknowingly be located at a prehistoric or historic site. If, however, scientific examination and recording accompany excavation for development, artifacts might be uncovered which add to our knowledge of earlier conditions and people. This could lead to a greater understanding and strengthening of cultural identity for local residents. There is a fine balance between excavating archeological/historical sites for the information they contain and retaining them undisturbed for their unique cultural or spiritual value.

Illegal digs by visitors and subsequent removal and sale of artifacts from the region is detrimental to the Native culture in particular and society as a whole. The sale of artifacts from private lands provides an important income source for several villages, though rare or unusual objects and those of great cultural significance are often lost to the commercial market. Amateurs or thieves might destroy evidence that could have proved valuable for later scientific investigation. The uncontrolled removal of artifacts precludes the recovery of their prehistoric, historic, or cultural value. The removal of artifacts by anyone other than professional experts also destroys valuable evidence that could provide priceless insights to and understanding of past cultures and societies.

5.6 METHODS OF MINIMIZING IMPACTS

- Encourage review of existing laws to see if they adequately protect prehistoric, historic, and cultural sites and punish violators appropriately.
- Encourage establishment of an ongoing program of inventory and cataloging of archaeological and historic sites in the Bering Straits CRSA.
- Develop criteria for determining which sites or types of sites should remain in existing condition, which sites could be altered, which sites should be excavated or put to another use, and under what conditions.
- Require developers to conduct historic and archaeological surveys prior to development activities.
- Encourage public and private funding of excavations and retain artifacts of special significance within the region.
- Establish one or more museums in the region for systematic recording and display of artifacts and relics.
- Encourage the Bering Straits School District to include appropriate elements of the Inuit culture and history of the region in the school curriculum to enhance children's understanding of their heritage
- Educate and sensitize new residents and visitors to the region on the cultural and spiritual significance of historic sites and laws governing unauthorized removal of artifacts from historic sites.



Bering Straits CRSA

Townships in which one or more cultural sites have been documented

NOTE: Remaining townships may also contain undiscovered or undocumented cultural sites.

SCALE

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Map 5-1
CULTURAL AND HISTORICAL SITES

Chapter 6: Oil and Gas Development

6.1 ISSUES AND CONCERNS

Major issues and concerns are whether oil and gas development will:

- harm fish, marine mammals, birds, and plants;
- use adequate, proven oil spill containment and cleanup technology;
- conflict with commercial fishing;
- provide employment opportunities for existing residents;
- increase local prices of goods and services; or
- adversely affect subsistence.

6.2 HYDROCARBON POTENTIAL

Development of oil and gas deposits in Alaska stimulates the state's economy and provides an important domestic energy source for the nation. DOI (1982) predicted a fourteen percent chance of discovering commercial quantities of oil and gas in Norton Sound. In 1985, DOI lowered their discovery prediction of oil and gas in Norton Sound to twelve percent. In 1983, Norton Sound OCS Lease Sale 57 was held. Six exploratory wells were drilled, plugged and abandoned when no commercial quantities of oil and gas were discovered. Navarin Basin OCS Lease Sale 83 was also held in 1983. Eight exploratory wells were drilled and, like OCS Lease Sale 57, were plugged and abandoned when no commercial quantities of oil and gas were discovered. As of June 1986, there has been no further exploratory activity in OCS Lease Areas 57 and 83. Norton Sound OCS Lease Sale 100 was scheduled for June of 1986 and cancelled in April of 1986 due to lack of industry interest. Upland areas of the region also hold little promise for oil and gas discoveries. Both state and federal upland leases have been offered but, to date, oil and gas potential of the upland areas of the region have not been pursued rigorously enough to stimulate industry's interest in these areas.

This chapter provides an overview of potential oil and gas development in the vicinity of the Bering Straits Region. The potential for oil spills and the social and biological effects of petroleum development will also be discussed. In the course of this discussion, opportunities provided by oil field development (e.g., employment and local investment opportunity) will be identified along with projected adverse consequences that should be avoided or minimized to safeguard sensitive habitats, use areas, fish, and wildlife, and the subsistence culture which depends on these resources.

Oil development in the region has been the subject of scores of lengthy, detailed studies addressing the many facets of oil development. For more complete and detailed analyses of oil and gas development see:

- Norton Sound Final Environmental Impact Statement (lease sale 57) (DOI 1982);
- Norton Sound Final Environmental Impact Statement (lease sale 100) (DOI 1985a);
- Recommendations for Minimizing the Impacts of Hydrocarbon Development on the Fish and Wildlife, and Aquatic Plant Resources of the Northern Bering Sea and Norton Sound (Starr *et al.* 1981);
- The Norton Sound Environment and Possible Consequences of Planned Oil and Gas Development (Zimmerman 1982);

- Natural Resource Protection and Petroleum Development in Alaska (USF&WS 1981);

- A Handbook for Management of Oil and Gas Activities on Lands in Alaska (Hanley, et al. 1983); and

- Identification of Potential Energy Facility Siting Locations in Norton Sound (Woodward-Clyde, 1984).

6.3 POTENTIAL DEVELOPMENT SCENARIOS

Exxon U.S.A. and ARCO began exploration activities in Norton sound to determine the presence of recoverable amounts of oil and gas. In accordance with standard industry operating procedures, an exploratory well that does not produce a significant find will be plugged and the site abandoned. If an exploratory well shows promising quantities of oil, additional wells will be drilled to determine if commercially-developable quantities of oil exist in the deposit. Offshore exploration requires onshore staging and support facilities. Without proper safeguards, growth of support facilities can place heavy demands on: offices and housing; electrical and phone utilities; water and sewer utilities; airports, docks, harbors, ports, and roads; schools; medical facilities; police and fire services; churches; and locally-available recreational resources. However, peak employment during the exploration phase probably would not exceed 100 jobs in the absence of promising discoveries.

Discoveries of oil in economically-recoverable amounts generally triggers the initiation of a development phase. Development includes drilling permanent wells and expanding the staging and support facilities into service bases complete with treatment plants, storage, and shipment facilities. Demands on supporting infrastructures also increase. In the Bering Straits Region production is projected to require year-round ship and plane service. DOI (1985a) projected that approximately 3,000 workers might be needed to construct facilities to bring moderate-size deposits into production. Once facilities are built (it would probably take three or four years) and production begins, employment levels would decrease. DOI (1982) projected that after production begins, annual job demand will be approximately 1,400.

The petroleum industry in Alaska is working to develop safeguards to reduce the chances of environmental damage and has taken some precautions, such as enclave development, to minimize social disruption. Offshore oil and gas development in western Alaska (considered a frontier province) poses special considerations that need to be addressed: strong currents and ice forces; biogenic and thermogenic gas-charged sediments; liquification of seafloor deposits; unique living resources and habitat; and a special dependence of the region's residents upon the habitat and living resources. Successfully contending with these unique conditions will require use of state-of-the-art technology. The importance of the region's living resources, as a source of survival, livelihood, and recreation, are international in scope.

In 1980 Dames and Moore analyzed potential effects of oil and gas development on the region's subsistence resources based on low, medium, and high-find scenarios. In their low-find scenario, reserves are discovered south of Nome in central Norton Sound. Reserves south of Cape Darby (inner Sound) and Cape Rodney (outer Sound) are added to those of the central sound for both the medium and high-find cases.

Low Find:

In a low-find case, drilling would occur eight months of the year, and vessels transporting oil or servicing wells or facilities might operate year-round. According to DOI (1985a), pipelines to carry oil to onshore storage, processing, and loading facilities would be constructed offshore, and processing, service, and support facilities occupying 90 or more acres would be built onshore. Cape Nome has the highest potential for development as an onshore support enclave, depending largely on the deposit's location. Woodward-Clyde (1984) identified other potential sites for onshore facilities at Port Clarence, Teller area, Nome, Klikitarik/St. Michael area, Emmonak, and Portage Roadhouse near Elim.

Medium Find:

A medium find would require increased marine tanker and ship traffic and perhaps a pipeline extension from Cape Nome to Rocky Point to service inner Norton Sound fields. A pipeline along the Seward Peninsula's southern shore would pass several seabird colonies (notably Bluff, the largest on the Seward Peninsula), and traverse commercial and subsistence use areas. In addition to a pipeline, 40 to 60 miles of road are projected between Solomon and Rocky Point. Habitat alteration and changes in fish and wildlife use patterns could occur. Fish and wildlife resources would be disturbed by road and pipeline construction (particularly waterfowl and fish in the summer). Wetlands west of Topkok Head could be avoided by careful route selection, but many small streams would be crossed. In addition, pipeline and road maintenance and pipeline monitoring could reduce bird nesting in adjacent areas and perhaps disturb other wildlife (Dames and Moore 1980).

High Find:

In the high-find case, approximately 10 to 15 miles of road are projected from Cape Rodney to the Nome-Teller Highway. Though no streams would be crossed, gravel would be needed for road construction. The additional projected onshore pipeline, however, would probably cross prime wetlands (waterfowl habitat), three major salmon streams, and two streams with smaller runs which support a significant proportion of the region's stocks. Construction camps and activity along the pipeline corridor would increase the potential for disruption of wildlife. Due to the influx of new workers and to improved access, sport fishing and hunting would probably increase in the area and cause conflicts with subsistence activities (Dames and Moore 1980).

If oil companies discover oil in outer, central, and inner Norton Sound, offshore pipelines, in addition to those required for low and medium-find cases, would probably be needed to bring oil and gas to an onshore plant. According to Dames and Moore (1980), an offshore pipeline from outer Norton Sound oil fields would connect with an onshore pipeline at Cape Rodney to deliver crude oil and gas to Cape Nome. Offshore pipelines and loading facilities might cross commercial and subsistence use areas along the Seward Peninsula's southern coast.

Development of petroleum reserves south of Cape Darby would increase the chance of oil spills and low-level chronic pollution to important salmon and herring fisheries in Golovnin Bay. Routing pipelines and placing wells west of the entrance to the bay would minimize impacts. Development of inner sound reserves would also increase the risk that oil slicks from spill incidents could reach nearshore seabird feeding areas between Rocky Point and Sledge Island.

6.4 OIL SPILL POTENTIAL

Petroleum development could produce chronic, low-volume hydrocarbon pollution – there is a sixty percent projected chance of a major oil spill in Norton Sound (DOI, 1985a). Because large oil spills can have disastrous consequences, they receive the most attention; however, small, frequent oil discharges can also cause serious long-term damage. Between 1973 and 1977, about fifty-five percent of the oil spills in Alaska occurred as a direct result of transportation, handling, and storage of petroleum and petroleum products. During normal operations and conditions, spills associated with oil trans-shipment, pipelines, drilling operations, and tankers are usually less than 1,000 barrels. Equipment failure, tanker accidents, well blowouts, severe weather, earthquakes, or other natural hazards may result in larger spills. DOI (1985a) estimates that, for Norton Sound, there will be 95 spills of less than 1,000 barrels, and that there is a seventy-eight percent chance of there being 2.44 spills of more than 1,000 barrels.

Oil companies have prepared oil spill response, containment, and cleanup plans that in the case of a spill, are intended to guide actions to prevent oil from reaching sensitive areas and resources. The effectiveness of these contingency plans in minimizing environmental damage would, at a minimum, depend on the location and magnitude of the spill, environmental conditions, quickness of deployment, and effectiveness of equipment and personnel.

The ultimate fate of a particular spill is almost impossible to predict when considering the large number of variables involved. These variable factors include the nature of the product spilled (e.g., crude or refined petroleum), the volume, weather conditions, season, ice cover, and containment response. Wind and current directions, and ice cover and movement are particularly important in oil-spill contingency planning. Winds generally have about twice the effect of currents on an oil slick or ice movement.

Oil released in eastern Norton Sound in the open-water season from July to October would likely be deposited on the northern shore of the Sound by winds prevailing from the south. A spill in western Norton Sound during this period could be carried into the northern Bering Sea. November and December winds shift, and an oil spill at this time would likely flow with drifting ice in a southwesterly direction. If oil were incorporated into ice as it formed, it could travel considerable distance before disintegrating, thereby widening the area contaminated (Zimmerman 1982). From January to April, sea ice is relatively stable, and an oil spill in Norton Sound would probably remain in that area for several weeks. For spills outside of Norton Sound, northerly winds would move oil more rapidly to the south. Because of the varying weather in spring and early summer, oil in eastern Norton Sound would tend to remain in the sound until deposited onshore, while oil released in western Norton Sound or in the Bering Sea would drift north into Bering Strait. In either case, variable spring winds would cause oil to accumulate in ice leads, areas of tremendous importance to migrating birds and marine mammals. These areas are either on probable tanker routes or near proposed Cape Nome facilities.

Chirkov Basin, roughly extending from St. Lawrence Island to Bering Strait, has the greatest probability of contamination from an oil spill originating in Norton Sound. Chirkov Basin is a major gray whale, walrus, and seabird migration and feeding area. The effect of an oil spill on this area and on the villages that rely on it largely depends on spill size, weather conditions, sea ice, available cleanup equipment, and the species and abundance of wildlife present (DOI, 1985).

In addition to possible effects from a spill in Norton Sound, waters near St. Lawrence Island could be affected by a spill originating in Navarin Basin (Sale 83) to the south. Also, Bering Strait villages and the northern side of the Seward Peninsula could possibly be affected by spills from Hope Basin development (State Lease Sale 45).

6.5 SOCIAL - ECONOMIC EFFECTS

Unless there is a spill, oil exploration conducted in compliance with applicable laws, regulations, and lease stipulations probably will have little long-term effect on the region. However, if oil companies discover and develop oil fields, the impact to the region could be considerable. Development of facilities at Cape Nome would have direct social and economic effects primarily on Nome, Council, Solomon, and Teller. The population could nearly double, and many types of social and economic activity would increase markedly in that community (Norton Sound FEIS; DOI 1982, 1985a). Development and activity are projected to increase along the roads extending from Nome. DOI (1982) noted that some King Islanders residing in Nome might relocate if that community grew dramatically. Prices for goods, services, and transportation from Nome are projected to increase, in response to greater demand. Marked price increases could cause hardship in regional villages as current household incomes are often barely sufficient to meet residents' needs. Conversely, villagers would not necessarily experience many of the positive benefits of development activities if prices dropped due to improved transportation facilities or competition. Some village residents might leave to seek oil development-related jobs. However, the greatest potential for disrupting village life is the loss or major reduction in subsistence resources in the event of an oil spill, chronic pollution, or extensive adverse impact to fish and wildlife habitats.

6.6 EMPLOYMENT OPPORTUNITIES

Most oilfield jobs would be filled by trained workers from outside the region (DOI 1985a). DOI also estimates that fewer than five local hires will result from OCS sale 100 activities between 1985 and 1994. As production declined, so would the workforce in Nome, and with it, the proportion of local hires. DOI (1982) projected that local opportunities for employment in construction, trade, and service-related jobs could result from oil development during the period of peak activity. Fewer of these jobs would be available as activity decreased. Few of the limited local hire opportunities would be available to the region's indigenous population on a long-term basis. As Ellanna (1980) pointed out, Eskimos typically work away from their village only long enough to satisfy immediate cash needs.

6.7 SUBSISTENCE CONFLICTS

Oil and gas activities and employees probably would have little direct positive effect on villages. However, activities which diminish subsistence resources or significantly disrupt harvests could have a severe adverse effect on a village's lifestyle, economy, and culture (Chapter 2, Subsistence). Oil spills, chronic pollution, and noise disruption have the greatest potential for adversely reducing or damaging subsistence resources. Increased recreational hunting and fishing, particularly in essential subsistence use areas, could also affect nearby villages. The Norton Sound FEIS (DOI 1982, 1985a) concluded that changes in local subsistence use would be inevitable. It also points out that with proper safeguards, the probability of a significant long-term reduction of subsistence harvest in the region as a whole could be reduced.

6.8 ENVIRONMENTAL EFFECTS

Oil and gas exploration, development, and production involve a multitude of activities with potential environmental consequences. Oil spills pose the greatest threat to the marine environment, but less drastic environmental damage, chronic pollution, and disruption of mammals and birds can also cause harm. Oil and gas related activities and impacts which could potentially harm fish and wildlife and coastal habitats include disposal of drilling muds and cuttings, release of formation and cooling water during drilling operations, water withdrawal, dredging and filling, gravel mining, gravel islands, shoreline alteration, noise and disturbance, oil contamination, toxic waste, and perhaps air pollution (Starr, *et al*. 1981). Additionally, development of onshore facilities could involve blasting, clearing, grading, dredging, filling, toxic runoff, sewage and garbage disposal, stream crossings, streambed excavation, and other construction activities which could adversely affect fish and wildlife.

A study entitled "An Environmental Evaluation of Potential Petroleum Development on the National Petroleum Reserve in Alaska" (USGS 1979) provides a comprehensive and detailed evaluation of the potential effects of onshore development. Starr et *al*. (1981) provides a detailed evaluation of both onshore and offshore development.

The extent of development depends on the location and size of oil and gas deposits. Ensuing effects depend on the extent of habitat loss or degradation, adaptability of wildlife, and whether activities such as vessel, airplane, and helicopter traffic, pipeline monitoring, and maintenance would affect habitat use and migration patterns (Starr *et al*. 1981).

Concerns with onshore development generally focus on the direct impact to fish, wildlife, and habitats in the vicinity of onshore terminals, other facilities, roads, pipelines and support infrastructures. Typically, offshore operations entail drilling, installation of pipelines, marine and airborne traffic, and other activities which have potential for oil spills and creating noise and disturbance. The more notable of these activities are briefly discussed here. Most attention is given to the effects of noise and disturbance and oil pollution; these impacts have the potential for the most widespread effects on fish and wildlife.

The oil industry makes substantial investments in the development of technology and in research focused on on minimizing the potential for environmental damage. Studies have estimated that the occurrence of most adverse effects of oil and gas development in the region could be minimized by use of best available technology. Dames and Moore (1980) indicate that marine mammal populations probably would be least adversely impacted by exploration phase activities of oil companies during ice-free months. Conducting exploration in spring and using ice leads as vessel routes could significantly increase the potential for adverse effects. Excluding oil spills, if oil companies follow precautionary measures (e.g., lease sale stipulations), wildlife populations, in the region as a whole, should remain stable during the exploration phase. Migrating waterfowl and seabird populations, however, may decline in localized areas due to noise and other disruption.

Properly conducted drilling activities cause some environmental degradation, but not to an extent that is typically characterized as particularly harmful. From a short-term perspective, such degradation may appear to be inconsequential. However, the long-term, cumulative aspect of such degradation can have significant impact and consequences. Discharge of formation water, which comes out of wells along with oil and gas, can release up to 50 parts per million (ppm) of oil as droplets or 35 ppm oil as dissolved hydrocarbons into the marine environment. Marine discharge of drilling muds have been shown to be toxic to fish and marine invertebrates in the immediate area of the discharge (Dames and Moore 1978). However, little is known of the widespread cumulative effects of discharging drilling muds to the marine environment. Drill cuttings have been shown to smother organisms at the discharge outfall.

Construction of shallow-water gravel islands, if needed for drilling operations, would primarily affect marine life during dredge and fill operations. Timing and location of such activity might be critical as increased turbidity could harm herring larvae and juvenile salmon. Invertebrate losses during construction could be significant if excavation or fill sites are in areas of significant invertebrate productivity. Widespread destruction of areas supporting large and diverse invertebrate populations could have subtle, long-term effects on fish, other invertebrates, and marine mammals (e.g., walrus, bearded seal, and gray whale) which feed on them or the food web supported by them. Construction of offshore pipelines and causeways may also disrupt benthic habitats, natural transport of sediments, and migration patterns. The construction of gravel islands during migration periods of adult and juvenile salmonids can also be highly disruptive (Dames and Moore 1980).

Oil field development would require onshore facilities occupying 90 or more acres (DOI 1982) and, depending on the location, could disrupt or deter wildlife use of the surrounding area. Noise, disturbance, and chronic pollution are primary concerns.

Construction and development activities in or near streams can induce or accelerate streambank erosion. Excessive sediment in streams can harm fish and other aquatic life. Sediment can smother fish eggs and reduce juvenile survival. Turbidity decreases the amount of light entering the water, thereby altering the stream ecosystem. If runoff from roads contains toxic substances, fish, invertebrates, and plants could be killed. In addition, building roads and pipelines along or across streams might destroy important riparian vegetation and thereby increase water temperature, eliminate cover, and perhaps reduce aquatic food production.

The extraction of construction materials (sand and gravel) from fish spawning and rearing areas can impair habitat quality and could eventually reduce populations. Use of heavy equipment and traffic at stream crossings during gravel mining operations in summer and fall could significantly degrade streams (Dames and Moore 1980).

6.8.1 Effects of Noise.

Noise and disturbance can adversely affect a wide variety of marine and terrestrial birds and mammals. For example, helicopter and other aircraft noise have been observed to disturb birds and other wildlife (Starr et *al.* 1981). Construction and operation of facilities, diesel generators, compressors, and other noise sources can also be disruptive. Birds and mammals have varying levels of tolerance to noise and disturbance. Sensitivity generally increases during breeding and rearing periods (Starr et al. 1981). Different types of disturbance elicit different responses. Nesting birds may flee low-flying planes, but may be seemingly unconcerned with the lower-level noise of passing boats (Woodby and Divoky 1982).

Startled seabirds are known to knock their eggs and young from the nest as they flee noise (Starr et al. 1981). Low-flying airplanes passing the colony at Bluff have resulted in hundreds of eggs falling from ledges (Springer, personal communication). Remaining eggs may perish if they become too warm or cold during the adult's fright-response absence. Unattended eggs and young may also fall prey to predators. Continued disturbance may cause birds to abandon important breeding, rearing, feeding, and staging areas (Starr et al. 1981). If birds or other wildlife abandon essential habitats, population declines may result from lack of suitable alternative habitat (DOI 1982).

Land mammals also can be sensitive to noise. Bears are intolerant of airplane and other noise, and they may avoid or abandon noisy areas. Bears are especially sensitive during denning and when concentrated in spring feeding areas along beaches and coastal grass flats. A strong or persistent disturbance can cause bears to abandon newborn cubs during or immediately following denning (Starr et al. 1981). Although brown bears show the most sensitivity to disturbance, other land mammals such as caribou, reindeer, and moose, also react to low-flying aircraft and other loud noise. Caribou, reindeer, and moose are generally most sensitive while calving or when clustered on winter ranges (Starr et al. 1981). Noise or disturbance which delays or discourages occupation of calving grounds might result in significant mortality among the weakened herd.

Many marine mammals depend on underwater acoustics for communication, location of food, spatial orientation, and predator avoidance. Little research, however, has been conducted regarding the effects of disruptive noise on marine mammals. Seals (particularly ringed, spotted, and harbor seals) and walrus flee haulout areas in response to low-flying aircraft (Pitcher and Calkins 1979). Persistent disruptions cause walrus to abandon a haulout site and, in extreme cases, they abandon their young (DOI 1982). Little Diomede residents report that Soviet helicopters scared walrus away from hunters (Eningowuk, personal communication). King Islanders report that low-flying aircraft servicing COST wells in Norton Sound drove walrus from traditional migration routes. Bearded seals appear to be less sensitive to aircraft, except in winter when they are easily disturbed. Belukha whales appear to be highly sensitive to noise; according to local elders, the installation and operation of a Federal Aviation Administration (FAA) beacon discouraged belukhas from entering the Unalakleet River estuary (Eakon, personal communication).

Evidence suggests that airplane noise penetrates water to some extent, as does noise from tankers, barges, drilling, seismic testing, offshore construction, and boats (DOI 1982). Most marine mammals can detect at least some of the sounds coming from icebreakers and tugs, but response to such noise varies greatly. Loud, sudden, and erratic noise seems to cause the most response and avoidance in some species (Starr et al. 1981). Reportedly, belukhas fled a barge operating 1.5 miles away (Starr et al. 1981). Bowhead whales have been reported to avoid small power boats with high-pitched engines but are not very sensitive to larger vessels.

Research suggests that icebreaker noise may interfere with marine mammal communication. Some scientists link underwater noise to whale strandings (Geraci and St. Aubin 1980). In general, the sounds that toothed whales make are broadband noises and clicks containing many frequencies, with most of their sustained vocalization at frequencies above 1,000 KHz (1 to over 100 KHz). Baleen whales, such as bowhead and gray whales, seem principally to communicate at frequencies below 1,000 KHz, but it can be up to 20 KHz. Finback whales may use 20-KHz noises for long-range signaling (Payne and Webb 1971). Ship traffic, seismic testing, and drilling activities are the most prevalent noise sources in the 5- to 200-KHz band (Payne and Webb 1971).

Seals and other marine mammals may learn to avoid areas of oil-related activities or other noise sources (Burns and Frost 1979). Continual disturbance may cause belukhas and bowheads to abandon certain areas, possibly moving out of the hunting range of subsistence hunters. Golovin residents note that seals have stayed away from their area since a noisy electrical generating plant was installed (Eakon, personal communication).

6.8.2 Effects of Oil Spills

This section provides a general overview of some of the most notable potential effects of oil spills and chronic oil pollution. It is not intended to provide a complete assessment of the many types of effects of oil on fish and wildlife. Due to its limited scope, this discussion does not address many of the effects of oil contamination which might impact the marine food chain or cause incremental reductions in some species' reproductive success or survivability. Likewise, it can not thoroughly evaluate the potential effects of oil on various life stages of all potentially affected fish and wildlife species or on their varying vulnerabilities in different habitats. Such concerns have been more thoroughly addressed in the major oil and gas studies listed at the beginning of this chapter.

According to Dames and Moore (1980), oil spills and chronic pollution could lead to: reduced herring, tomcod, and crab abundance through slowly-increased egg, larval, juvenile, and adult mortality over a period of years; increased levels of hydrocarbon metabolites in tissues of tomcod, herring, salmon, king and tanner crab and perhaps bearded and spotted seals, walrus, belukha, gray, and bowhead whales; and increased mortalities of waterfowl and seabird chicks as a result of the presence of hydrocarbons in prey species. Sublethal effects of oil contamination include the reduction of a species, reproductive success or survivability. In addition, an oil spill that depletes plankton and other building blocks of the food chain reduces the productivity and carrying capacity of the marine environment (Zimmerman 1982).

In general, wildlife habitats most sensitive to oil pollution include eelgrass and kelp beds, wetlands, tideflats, lagoons, estuaries, herring spawning areas, seabird colonies, seabird feeding areas, and juvenile fish rearing, migration, and feeding areas (streams, lakes, estuaries, and nearshore areas).

Habitats moderately sensitive to oil pollution include herring feeding and rearing areas, capelin spawning areas, king crab gathering areas, waterfowl staging areas, marine mammal haulouts, and clam beds (Starr et al. 1981). The Norton Sound coastline has been surveyed to identify the presense of coastal habitats most sensitive to oil contamination and the most effective techniques and procedures for protecting them in the event of an oil spill.

6.8.2.1 Marine Mammals

Peak marine mammal abundance in and near current lease sales generally occurs between May and June and between September and December; at this time, thousands of seals and walrus and some whales migrate through the northern Bering Sea. Little conclusive information is available regarding the effects of oil spills and resultant pollution on marine mammals. Seals, walrus, and whales may avoid open water oil slicks, but ice leads may confine animals to contaminated areas. Ingestion of oil can distress adults and kill young.

Seals appear to be most susceptible to the adverse effects of oil pollution during pupping. The most widely distributed and most abundant seal population in the Bering Straits region is the ringed seal. Seal pups and ringed seals are vulnerable to oil contact, as it reduces their fur's insulating properties (Burns and Frost 1979). Under laboratory conditions, Geraci and Smith (1977) demonstrated that ringed seals immersed in crude oil for 24 hours suffered short-term stress, eye irritation, minor kidney damage, and possible liver lesions. Engleherdt (1977) showed that this species absorbs petroleum hydrocarbons through the skin or respiratory system and by ingestion, but is apparently able to excrete or detoxify hydrocarbons at least on a short-term basis. Villagers have reported that seals appeared to be blind after repeated oil contact, and walrus may also suffer eye problems from oiling. Polar bears appear to be greatly stressed after swallowing oil or oil-contaminated prey (DOI 1982). Canadian studies have shown these bears experience renal (kidney) failure from grooming heavily oiled fur (Zimmerman 1982).

Bowhead whales are most common between November and April, and gray whales are most common between June and September. Bowhead and gray whales swallow large quantities of water when feeding and have been found to foul their baleen as they strain their food. Ingested oil could possibly have a toxic effect on metabolism.

metabolism, digestion, and reproduction (DOI 1982). Gray and bowhead whales are the most likely whales in the region to be affected by contact with or ingestion of pollutants resulting from oil spills (DOI 1982). Indirect effects of spilled oil (e.g., resulting from reduced or contaiminated prey) are more likely for gray whales, which have extensive benthic feeding grounds in Chirikov Basin of western Norton Sound. Bowhead whales, which are suspected not to feed as extensively in the area as the gray whale, are not so likely to be as heavily impacted during their migration through the region.

Spills originating in Norton Sound and traveling toward St. Lawrence Island and Chirikov Basin could contaminate breeding and feeding areas and migration routes for several wildlife species that utilize that area (Volume 1, Map 10). The immediate effects of oil contamination would probably be short term, although the cumulative effects of contamination of bottom sediments and prey species could have long-lasting adverse impacts on walrus, bearded seals, and gray whales which feed along the bottom on invertebrates.

Contamination of feeding areas used by gray whales and seabirds and their prey could, according to the Norton Sound FEIS (DOI 1982, 1985a), trigger an avoidance response and possibly reduce these wildlife populations. Dangers to bowhead migratory corridors would probably be greatest in the Bering Straits, which could receive tanker traffic from more than one lease sale. A major oil spill which displaced or reduced the population of bowheads, walrus, or seals could have serious effects on the villages of Gambell, Savoonga, Diomede, Wales, and Shishmaref. Savoonga and Gambell are particularly susceptible, as their culture and survival are based on subsistence harvests of marine mammals, particularly whaling (DOI 1982).

6.3.2.2 Fish and Shellfish

Low hydrocarbon concentrations can kill fish and shellfish eggs and planktonic larval stages. Numerous sublethal effects can reduce survivability and reproductive success of many species. A large oil spill (particularly within a few miles of shore) could be disastrous for migrating salmon and other fish. Oil pollution along salmon migration routes could block or delay migration and kill outmigrating smolts and fry. Juveniles lingering to feed in lagoons, estuaries, and nearshore waters from late spring to July would be most vulnerable, particularly in areas with poor water circulation and flushing action. An oil spill could also damage plankton upon which salmon smolt feed, thereby reducing smolt growth and survival rates (Starr et *al.*, 1981). Oil might also interfere with the sensitive homing mechanism cues used by returning adult salmon.

Of all the salmon life stages (egg, alevin, fry, smolt, juvenile, and adult), fry emerging from the gravel are the most sensitive to oil contamination. Red and silver salmon fry in a holding tank died within hours after exposure to an oil slick (Morrow 1973). Pink salmon fry died when exposed to oil concentrations as low as 1.41 parts per million (ppm). Soluble, aromatic hydrocarbon derivatives in concentrations as low as 10 to 100 parts per billion (ppb) can disrupt salmon feeding and reproduction (Starr et *al.*, 1981). Due to limited research, the ability of salmon to avoid contaminated areas is uncertain. Pink salmon juveniles have been able to detect and avoid oil concentrations as low as 1.6 mg of oil per liter of water; however, trout and Atlantic salmon have failed to avoid lethal crude oil components (Starr et *al.*, 1981).

Offshore oil development could affect salmon eggs, fry, and juveniles in intertidal areas. Pink salmon eggs and fry are among the most vulnerable to marine oil spills because adults often spawn in intertidal areas. Chums rearing in lagoons are also highly vulnerable. A spill in or transported to a confined rearing area (e.g., a lagoon) could kill a large portion of the fish present (Barton 1978). A major coastal spill could result in the loss of a substantial portion of the region's salmon population for an indefinite period. Such a loss could have devastating consequences for commercial and subsistence fishermen and users.

Other anadromous fish, such as Arctic char, whitefish, sheefish, and smelt, could also be adversely affected by oil pollution. Long-term chronic pollution as well as spills could disrupt feeding, migration, and spawning (Barton

1978). Since fry and juveniles of most of these species remain in freshwater drainages, they are less susceptible to marine oil contamination during their most sensitive life stages.

Herring spawn annually along the same sections of the region's coast (Volume 1, Map 6). They support the region's most profitable fishery and provide a major food source for fish, birds, and marine mammals. Herring are also an important subsistence resource. Large schools of herring spawning in shallow water in spring and early summer are extremely vulnerable to oil pollution; spawning success and larvae survival could be greatly reduced by oil pollution. Oil seeping into spawning areas, including low-volume chronic discharges, could coat and kill eggs. Herring larvae have been killed by 96-hour exposure to 3 ppm of the water soluble portion of crude oil (Rice et al. 1976).

According to Barton (1978) a major oil contamination of herring spawning habitats in spring could have catastrophic effects on the productivity of this species. Herring spawning in shallow lagoons, bays, and inlets where water flushing is slow would be extremely susceptible to pollution. A major oil spill reaching herring spawning habitats during spawning periods could kill an entire year's offspring (Barton 1978). The location, timing, and extent of an oil spill will determine the severity of its damage to the region's commercial and subsistence herring fisheries (Barton 1978). Terminal facilities at Cape Darby or Port Clarence (the only deepwater port north of Dutch Harbor), would pose a major threat to the region's herring fishery (Lowry et al. 1978, Barton 1978).

Herring and other marine and anadromous fish (e.g., Arctic char, smelt, sheefish, and whitefish) could be severely affected by oil pollution in coastal wintering areas. Herring juveniles wintering in lagoons along the Seward Peninsula are particularly vulnerable (Barton 1978). Port Clarence and especially Imuruk Basin, which support large schools of wintering and juvenile herring and other species, are highly sensitive to oil pollution (Barton 1978).

Eggs and larvae of other forage fish (e.g., capelin and sandlance) and larger fish (e.g., yellowfin sole, starry flounder, pollock, and cod) and such shellfish as king crab and shrimp can be killed or deformed even by low hydrocarbon concentrations. Pollock, some cod, and king crab egg and larvae are particularly susceptible to oil contamination floating near the surface in currents that could carry spilled oil. Cod and pollock eggs collected in the vicinity of a major spill (the Argo Merchant) were either dead (46%) or grossly malformed (18%) (Starr et al. 1981). Arctic cod, a major forage fish, spawns below the ice (which would largely shield them from contamination) where eggs remain for up to six months. While near the surface they are highly vulnerable to any oil reaching them (Zimmerman 1982).

Other species (saffron cod, capelin, sandlance) critical to the subsistence and marine food chain have demersal eggs which may lie buried in sand until they hatch. Oil spills in these areas and subsequent movement of oil into sediments could cause extensive mortalities of hatching fish (Zimmerman 1982). Hydrocarbons which settle in sediment would gradually enter the food chain over several years and contaminate benthic organisms and bottom-feeding fish, shellfish, and marine mammals. Clams and cockles are highly susceptible to oil contamination. They accumulate certain hydrocarbons rapidly and retain them for long periods. People, walrus, bearded seal, birds, crabs, and fish that feed on tainted shellfish can also be affected (DOI 1982).

Tanner crab are extremely sensitive to oil contamination. Tanners exposed to the water soluble components of crude oil as low as 0.32 ml oil/liter lost several legs (Karinen and Rice 1974). Exposure to crude oil levels of 1.2 ppm for 48 hours has reduced molting success to zero. Failure to molt usually results in death (Starr et al. 1981). Oil contamination may also promote shell disease and cause plat loss (Norton Basin Synthesis Meeting 1984).

An oil spill in a confined area could kill shrimp larvae and, perhaps, adults. Researchers have reported that shrimp collected after a drilling operation exhibited indications of petroleum contamination.

6.5.2.3 Birds

Oil spills could result in severe bird losses, especially for diving ducks and seabirds, the most sensitive of all wildlife to oil pollution. Oil coating their down can cause hypothermia, shock, drowning, and increased vulnerability to predators. Birds may also be poisoned by ingesting oil when trying to clean their feathers or become immobilized and die of starvation. Bird populations may take 20 to 50 years to recover from major losses (DOI 1982). Large oil spills have resulted in massive bird kills, the precise toll being difficult to estimate as most dead birds sink or remain undetected at sea. In 1970, as many as 100,000 seabirds died after being fouled by an oil spill off Kodiak Island. That same year, at least 10,000 Cook Inlet birds were killed by oil apparently pumped from a tanker's ballast tanks (Starr et al. 1981).

The length of time a spill remains on the surface and in the water largely determines bird mortality. Persistence of a slick increases the likelihood that feeding and nesting birds will be fouled with oil. Presence of oil in the water column increases the chance that diving birds will be contaminated. The five to six million seabirds present in the Bering Straits Region are most vulnerable in the spring when they congregate in ice leads and other confined open water bodies. A spill at these locations at this time could result in death of more than half of the affected birds. In the fall, thousands of murres migrate long distances by water and, therefore, would be extremely vulnerable to contamination from an oil slick in their path (Drury et al. 1980).

Spills from Norton Sound affecting offshore feeding areas between May and October would also be devastating to seabirds present in the area. These areas also could be fouled by a tanker accident or spill originating in Navarin Basin or Hope Basin. The nesting cliffs on St. Lawrence Island's Northeast Cape are particularly sensitive to being fouled by an oil tanker spill. Such a disaster could seriously harm the large flocks of seabirds and waterfowl that depend on the area (DOI 1982). The most likely source of a spill reaching feeding areas is a pipeline accident or a spill at a tanker loading facility at Cape Nome (DOI 1982). Besides causing adult mortality, oil slicks carried into seabird feeding areas before the hatching period could result in extensive egg mortality in nearby colonies.

Contamination or loss of prey could also have serious adverse effects on seabird survivability at nesting time (Drury et al. 1980). Like seabirds, waterfowl and shorebirds are vulnerable to oil spills during spring and fall migrations and during the molting period, when large flocks gather along the coast in ice-free bays, lagoons, wetlands, lowland ponds, and river mouths (Volume 1, Map 9). Birds congregating at these areas are extremely susceptible to oil contact, disruption, reduction, or contamination of food (Table 6-1) (Starr et al. 1981). Birds such as emperor geese which feed in seagrass flats and shallow waters, gather in large "rafts". Cape Woolley, Cape Nome, and the rocky shore from Tolstoi Point to Stebbins are frequented by diving ducks (Woodby and Divoky 1982a). Canada geese are most vulnerable in late summer when as many as 100,000 pass through the area. After breeding, waterfowl molt and are unable to fly until new feathers appear. They remain on the water during this period, where they would be highly vulnerable to spilled oil.

Peregrine falcons could be indirectly affected by oil spills if feeding on oil-contaminated prey (e.g., weakened waterfowl and seabirds). Gulls and terns might also attempt to feed in oil contaminated areas, particularly if they are attracted to fish killed by the spill incident. Oil on feathers could be transferred to their eggs or ingested when preening contaminated feathers. Other shorebirds may feed or roost in contaminated areas or feed on contaminated prey. Shorebird dependence upon wetlands for nesting and feeding makes them vulnerable to oil washed over wetlands. The Stebbins wetlands, which support the largest flocks of shorebirds along the Norton Sound Coast (about 86,000), are among the most vulnerable to oiling in the Bering Straits Region (Woodby and Divoky 1982a).

6.6 METHODS FOR MINIMIZING IMPACTS

- Avoid seismic activity in areas occupied by pupping seals.

TABLE 6-1: EXPECTED IMPACTS OF OIL DEVELOPMENT ON COMMON BIRDS IN NORTON SOUND

Species	Loss of Nesting Habitat	Disruption of Nesting	Increased Hunting	Oiling by Contact	Oiling of Prey	Expected Population Change
Loons	M	M	L	H	L	—
Waterfowl						
Swans	L	M	L	M	L	—
Geese	L	M	H	M	L	—
Diving Ducks	L	M	L	H	L	—
Dabbling Ducks	M	M	H	M	L	—
Cranes	L	M	M	N	L	—
Jaegers	M	L	L	L[1]	M	—
Gulls	L	M	N	L	L	+[2]
Terns	M	M	L	M	L	—
Passerines	L	L	L	L	L	0[3]

Levels of impact are predicted as high (H), medium (M), low (L), or none (N), and population changes are predicted as increasing (+), no change (0), or decreasing (–).

1. Most shorebirds would be unlikely to contact spilled oil directly, although phalaropes sit on water to feed and would be more prone to oiling.

2. Glaucous, mew, and other large gulls would probably show an increase in population, but smaller gulls might remain the same or dwindle. Large gulls thrive on refuse of human activities.

3. Most passerine populations would probably not be affected, although ravens might increase due to the proliferation of refuse.

Source: Woodby and Divoky 1982.

- Inform local communities, regional service organizations, and commercial fishermen of development activity plans of operation, schedule, and location.

- Employ strict operating and safety methods whenever large quantities of petroleum products are involved.

- Oil production facilities should be specifically tested to operate safely under conditions of high winds, extreme wave height, and heavy ice.

- Site oil storage facilities away from open water and within impermeable containment dikes large enough to contain the contents of the storage facility in the event of a leak.

- Avoid siting oil production and storage facilities in areas of high or important fish and wildlife concentrations and in geophysically unstable areas.

- Effluents from oil treatment facilities should be treated to reduce concentrations of aromatic hydrocarbons.

- Discharge effluents into marine waters only in strict accordance with approved discharge procedures that ensure there is sufficient water volume, tidal currents, and water exchange to allow for rapid dilution with minimal environmental consequences.

- Oil tankers and barges should be required to meet Coast Guard standards and to have "load on top" or segregated ballast tanks.

- Tanker/barge docks and fueling facilities should be designed and equipped with automatic shut-off and back-up safety systems.

- Avoid discharge of turbid waters in aquatic habitats, particularly during critical life cycle phases of anadromous fish and/or during periods when background levels of sedimentation are low.

- Anchor points for oil exclusion booms should be identified at the mouths of all anadromous fish streams, lagoons, estuaries, and bays vulnerable to major oil spill incidents.

- Encourage recycling of drilling muds.

Chapter 7.0: Mining and Mineral Development

7.1 ISSUES AND CONCERNS

Major issues and concerns are whether placer, lode, dredging, and other mining operations and mineral processing will:

- result in accelerated socioeconomic and cultural change;
- be economically and technically feasible;
- provide for maintenance of water and air quality;
- adversely affect fish and wildlife;
- adversely affect subsistence resources and activities.

7.2 MINERAL POTENTIAL

Gold sparked major mining activity and development in the region at the turn of the century. Several new towns developed (Nome, Council, Solomon, and Teller), roads and railroads were built, and the region's almost nonexistent cash economy boomed. An expanded population opened new economic opportunities for merchants and reindeer herders. Local employment opportunities abounded. The region's fish and wildlife populations were impacted by high harvest levels and disturbances, and streams were seriously damaged by unstemmed mining activities. This short-lived era disrupted and changed the way of life of the indigenous population. With the depletion of the gold fields, miners left, towns fell into disrepair, and the many who had come to depend on a cash economy were left unemployed.

Mineral resources are an important asset to the Bering Straits Region where deposits of state and national importance have been identified. Current mineral development has brought economic, environmental, and cultural change to the region. A state-funded study has predicted that in the coming decades, growth of the mining industry in Alaska has the potential to surpass that of oil, tourism, or timber. Large-scale mineral development could create employment for local residents, income for the regional and village native Corporations, and a local tax base as well as increase access, services, and facilities — all of which are generally favored by local residents. At the same time, mining could cause environmental and cultural changes opposed by local residents. Care must be taken to ensure that new eras of large-scale mineral development are more sensitive to the region's environment and people than previous mineral development. The Bering Straits Native Corporation (BSNC), with mineral rights to much of the region, has a development policy that encourages mineral development in a manner that minimizes environmental damage and maintains the subsistence way of life.

Hardrock tin-tungsten-fluorite deposits at Lost River, approximately 80 miles northwest of Nome, represent the region's most promising mineral prospect (Volume 1, Map 6). However, unfavorable world market conditions have stalled initiating development activities. Gold lodes in the Nome Mining District are another example of hardrock mineral prospects that are currently undergoing exploration (e.g., Mt. Distin, 18 miles north of Nome). In 1983, Pacific Cornwall Enterprises investigated the patented mining claims at the old Big Hurrah Mine near Solomon and is continuing to negotiate for exploration rights to land adjacent to the mine. In 1983, to spur more exploration and mining in the region, the federal government opened approximately one-eigth of the land in the Bering Straits CRSA to mineral development. The Alaska Department of Natural Resources has identified extensive areas within the region as having high to very high potential for the presence of mineral deposits (Map 7-1).

Currently, numerous widespread and generally small-scale placer mines operate on the Seward Peninsula. Placer activity is directly linked to gold prices. Strict enforceent of water quality regulations might curtail some operations which cannot afford equipment to comply with water quality standards when gold prices are relatively low. Large-scale placer dredging operations are ongoing offshore near Nome, where valuable seabed gold concentrations are documented. There are indications that significant concentrations of placer gold may also be present in Imuruk Basin, offshore from Daniels Creek (near Bluff), and at other locations along the Norton Sound coast.

Sand and gravel extraction could be extensive along the coastal shoreline and some upland areas in the event of oil and gas development or other large-scale projects. Excavation of materials from village or regional corporation land could be of substantial local economic benefit, if conducted in a manner that avoids serious habitat damage.

The remainder of this section addresses the potential economic, social, and environmental consequences of mineral development in the region. Topics are addressed in the same order as the issues and concerns are listed. The relatively detailed descriptions of the potential costs of mineral development are not intended to deter mining, but rather to identify potential problems that must be avoided or minimized to protect the resources, habitat, and lifestyle upon which most of the residents of the region depend for physical and cultural survival.

7.3 SOCIOECONOMIC AND CULTURAL CHANGES

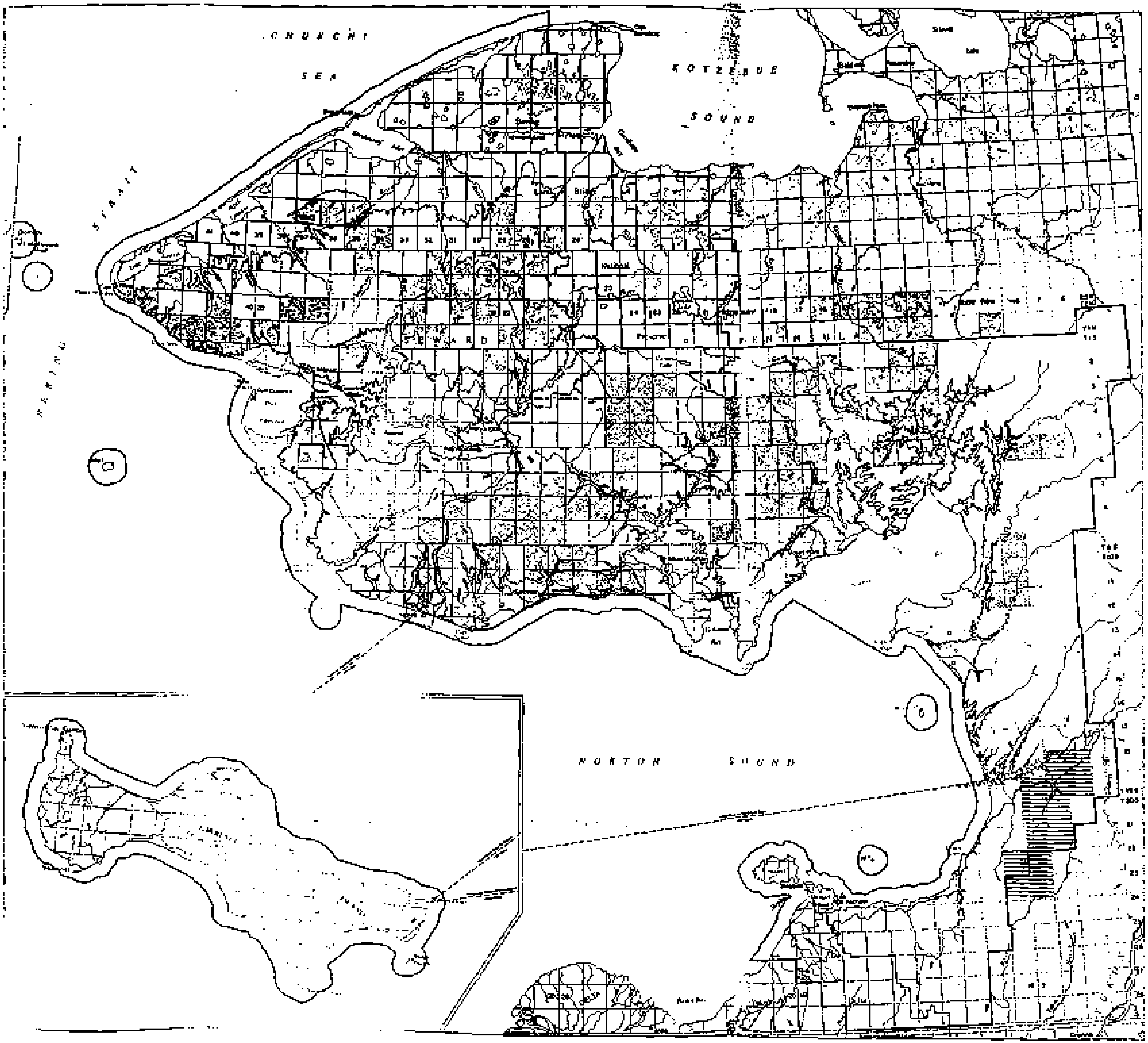
Minerals, oil, and gas are the only resources in the region with the potential for sustaining large industrial development. In the absence of such development, economic activity in the region will likely remain low.

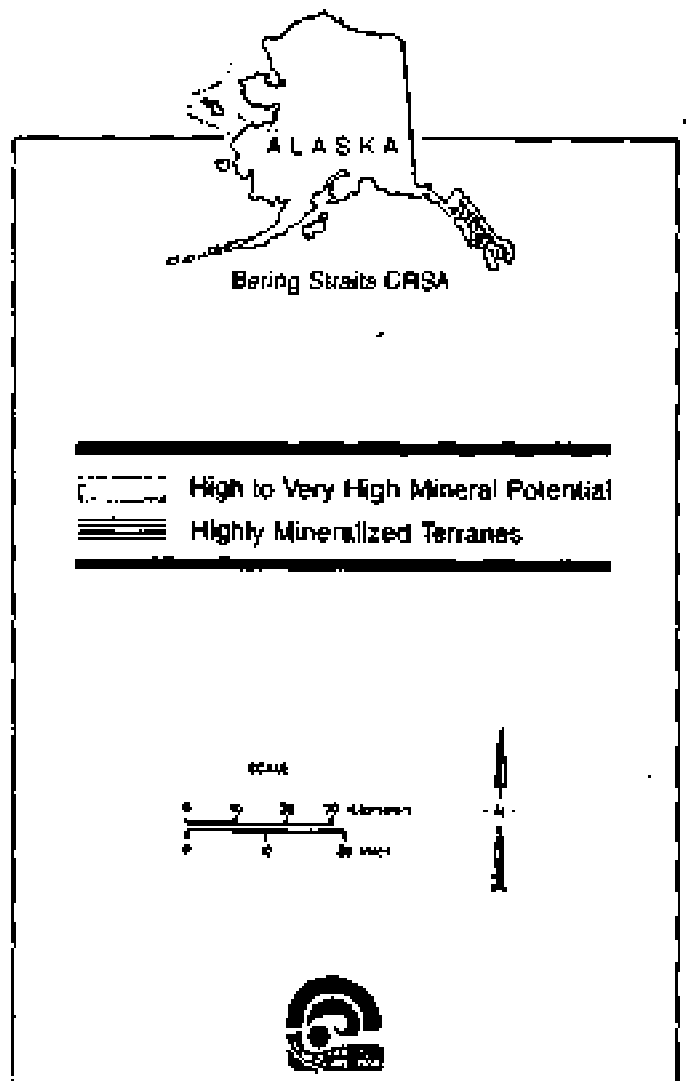
Projected social impacts of potential resource development are difficult to quantify. Nonetheless, perceived benefits must somehow be balanced against costs to allow for prudent planning. Currently, government spending accounts for the bulk of the region's economic base. BSNC, a leading economic and political institution in the region, could support the region's economic base by developing mineral deposits under its control. Village corporations could benefit economically from the development of mineral and/or sand and gravel deposits. Villagers employed in mineral development and corporation shareholders could also benefit from such development. A strong economic base relying on mineral development might assist Native corporations to become financially stable. Mining operations within a city's jurisdiction could create a local tax base. A large-scale operation has the potential for providing the economic foundation for establishment of a borough government. Development of Native-controlled land could mean more local hire and regional retention of profits than deposits developed on non-Native land.

To yield the most economic benefits for the region while minimizing costs, resources must be developed with maximum local involvement. Benefits must flow to local people. In the past, profits from development of the region's minerals were removed, leaving little income to be filtered down to local residents. The region's large mining endeavors have traditionally hired the majority of its employees from outside the region. These workers do, however, spend money in Nome and thus bolster the local economy. Besides direct mining employment, numerous support industries frequently spring up around major mining operations. Generally, for every job created by such development activities, it is not unusual for two or more support jobs to develop. Subcontractors are needed to provide infrastructure, support and maintenance. In addition, new people coming into the region as a result of such development activities provide a larger market base for indigenous arts and crafts products.

When properly administered, local hire at a mine or support business can provide upward job mobility for the regions's local labor pool. Vacated positions can become available to other residents, resulting in a wider talent pool and increased employment capabilities/opportunities.

The extent to which local villages would benefit from development activities largely depends on their proximity to the development activity. Eventually, the majority of cash would flow through Nome as it serves as the region's transportation and services center and lies relatively close to the region's most heavily mineralized areas (Map 7-1). Village cash economies can benefit from mineral development to the extent that local employment opportunities and material standards of living increase.





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Map 7-1
HIGH POTENTIAL MINERAL AREAS

Mining historically has been the catalyst that sparked development of transportation systems in new communities such as Nome, Teller, Solomon, and Council. The improvement of regional transportation systems and infrastructure ranks as one of the greatest impacts of mineral development. In addition to the economic benefits of new jobs and creation of support business, development or expansion of overland transportation systems (roads and perhaps short-haul railroads) and a port has far-reaching sociocultural/socioeconomic implications. Shipping costs for fuel and other cargo (food, building materials, vehicles, etc.) delivered to the region might drop significantly because larger, bulk shipments would lower costs per unit and improved port facilities and road networks would reduce handling.

Development of the Lost River deposit would result in substantial growth in Nome and perhaps other communities in the vicinity. Much of the population increase would result from secondary economic growth such as expansion of support and service-oriented businesses. Additional goods and services could become available, though increased growth could require improved schools, health care, and community facilities. It is projected that perhaps as many as a thousand workers may be needed to initiate large-scale mining operations at Lost River. Logistically, it is cost-effective to house mine employees in a new settlement near the mine site. With a projected life of at least 16 years, a work force of approximately 200 would be employed year-round to monitor operations. Of these, about 125 jobs, mostly skilled labor, could be recruited from the region (DOI 1976). Local training in needed skills would enhance the chances for local hire.

In examining the other aspects of mineral development, it must be recognized that the majority of the region's residents remain economically and culturally oriented to a subsistence lifestyle. Major development could enhance regional and local cash economies and accelerate the development of transportation systems. Major development could also lead to accelerated assimilation of indigenous populations into nontraditional life-styles. Such acceleration has a large potential for undermining the subsistence way of life in affected villages. Adverse impacts from development-related population increases could be mitigated by requiring that development sites be located away from villages.

Also, World market price and demand fluctuations can cause mines to close and create periodic unemployment. A mine closure could cause hardships for individuals who have become cash dependent on on a cash economy, at the expense of their subsistence economy. However, a high percentage of full-time employment in a village would leave people with less time to develop, practice and/or participate in subsistence activities. Traditional culture and values would suffer as a result. Relevant seasonal leave, for subsistence activities, could lessen such problems and result in a higher level of local hire.

A substantial influx of newcomers to existing villages will alter community character and lifestyles. Rapid population growth, resulting from newcomers could create new employment opportunities and also raise living costs. Such growth could also increase local labor and living costs. These types of sociocultural and socioeconomic changes have the potential for creating hardship for the original residents who are unable to take advantage of employment opportunities. Newcomers are likely to compete with local residents for fish and wildlife resources and this competition for limited resources could result in increased conflict over sport/recreation harvest of subsistence resources. In addition, improved or new access to habitats and resources by nontraditional users has the potential for disrupting the delicate subsistence web that is the foundation for the economics of the region's villages.

The potential impacts to fish and wildlife populations and habitats from extensive mining activities, mineral processing, transportation, and associated facilities is an important concern. The maintenance of a subsistence lifestyle is totally dependent on the continued functioning and productivity of fish and wildlife habitats. Mining activities encompass a wide spectrum of potential adverse impacts to the lands and waters of the region which provide the life history requirements of subsistence resources. Mineral development must recognize the importance of the land, the habitats, and the fish and wildlife populations and accommodate their protection into development planning and operation.

7.4 ECONOMIC AND TECHNICAL FEASIBILITY

Development of large hardrock mineral deposits in northwestern Alaska is contingent on locating a marketable deposit, obtaining the financing required to bring mines into production, favorable market conditions, and adequate transportation systems. Currently, development of several major prospects are stalled because they cannot be developed economically. When it can be demonstrated that a marketable product can be produced, development will proceed.

Alaska's mining industry is at a disadvantage, relative to the "Lower 48" because of limited major transportation systems. To overcome this disadvantage, the state is exploring funding alternatives for needed roads and ports. A February 1984 study by the Alaska Department of Commerce and Economic Development identified mining projects which would benefit from state funding to assist with development of transportation infrastructures. The report includes port expansion and roads to serve the Seward Peninsula. Expenditures of sufficient magnitude to develop these transportation infrastructures would probably not be made until the world market conditions for minerals improve. In addition, the development of a transportation infrastructure might not, by itself, make the large scale mineral projects feasible. However, it could stimulate the industry and increase the likelihood of mineral development.

To enhance the potential for resource development and to improve the region's ports and other transportation facilities, design of such facilities should maximize potential for other uses, enhance the feasibility of other resource development, and improve regional infrastructures. Economic feasibility of some projects would depend on shared use of ports, roads, or other facilities. Roads linking settlements, mineralized areas, and port facilities are particularly well-suited to multiple use. Availability of expanded road systems into previously remote mineralized areas could stimulate mining activity.

Discovery and development of petroleum reserves in Norton Sound would require construction of port facilities and overland roads. Depending on location, such development could facilitate mineral development. Important mineral or other resource prospects should be considered in site choices and design of transportation infrastructure developed primarily in response to the needs of the hydrocarbon industry. Location and design of major transportation facilities should be coordinated with the public sector land management plans/strategy programs relevant to the area.

The technical feasibility of developing some identified mineral deposits is well-established. However, in other cases, particularly offshore placer mining, further improvement of available technology is necessary. Extreme weather conditions and seasonally rough seas (late summer and fall) are characteristic of the region and these factors must be carefully considered to insure a reasonable chance for successful offshore operations. Further refinement or development of economical equipment and mining methods may be necessary to enable in-stream placer operations to comply with state water quality standards.

7.5 MINING ACTIVITIES

7.5.1 Placer Mining

Placer mining entails direct disturbance or removal of streambanks and substrate to obtain target minerals present in the alluvial sand and gravel. Due to the location of the mining activity and the process used to separate the mineral, placer mining has the potential to impact adjacent water courses by increasing the levels of settleable solids, suspended solids, and turbidity in the stream by several hundred percent (Kolankiewicz 1982). Water downstream from sluicing operations has higher turbidity and temperature levels than under natural conditions. The pH and dissolved oxygen levels of the processing water have been shown to decline as much as ninety-five percent (95%) after processing through a sluice. Even after outflow from placer mines is allowed to settle in ponds before discharge (the common method for reducing turbidity and sedimentation), levels of clay-sized suspended solids often exceed state water requirements (Kolankiewicz 1982). Because placer mining operations are widespread on the Seward Peninsula and historically have been a source of suspended solids affecting miles of streams, the effects of water quality degradation resulting from mining activities and mine abandonment activities is of concern to local residents and regulatory agencies.

7.5.2 Sand and Gravel Extraction

Along with depletion of sand and gravel bars and spawning areas, in-stream gravel extraction can increase sedimentation and turbidity. Depending on the extent and duration of activities, effects on the aquatic environment could be similar to those of placer mining. In-stream sand and gravel extraction can produce changes in stream channels, which can result in accelerated stream bank erosion, trapping of fish, loss of spawning areas, increased water velocity, and decreased productivity in the stream (Woodward-Clyde 1980).

Upland excavation of sand and gravel construction materials is generally considered to have less potential for degrading water quality of adjacent watercourses than instream mining. However, improper upland mining could cause turbid waters and sediment to enter drainages, resulting in adverse effects to downstream aquatic systems, including wetlands.

7.5.3 Offshore Mining and Dredging

Marine mining has occurred in the region at least since the 1930's. An attempt to begin dredging operations near Bluff in the fall of 1983 was abandoned when a severe storm destroyed the dredge before the project's economic viability and environmental impacts could be ascertained, or even appropriate permits obtained. In 1984, the State Division of Minerals and Energy Management reopened all state tidal and submerged lands to mineral exploration. This action has stimulated offshore mining development.

Dredging is accomplished with mechanical scoops or by hydraulic suction. Both forms of dredging increase turbidity and sedimentation in the immediate area of the mining activity; the areal extent of the impact is governed primarily by water circulation patterns. Increased turbidity associated with offshore mining and dredging is a major consideration in areas with slow flushing action and poor circulation (e.g., lagoons or sheltered bays). In some areas, dredging seabed sediments could suspend naturally-occurring toxic heavy metals into the marine environment, posing a possible threat to marine life and ultimately humans. Offshore sediments which contain gold often contain heavy metals in conjunction with the target mineral.

7.5.4 Lode (Hardrock Mining)

Unlike placer mining and dredging which require few support facilities, the economic feasibility of developing remote deposits of minerals contained in rock formations may be dependent upon construction of support facilities and a transportation system. Lode mining and associated development could significantly lower water quality if appropriate safeguards are not implemented to minimize erosion, discharge of toxic effluents, and other sources of water quality degradation. Chemically-treated ore tailings and heavy metals which are not properly handled and disposed of can pollute an entire drainage. Groundwater and surface water can be contaminated by direct discharge or seepage from operation and/or abandonment of mines.

A "real-life example" of the possible consequences of mining development is contained in the Lost River Environmental Impact Statement (DOI 1978). Currently, no other lode deposits in the region have been similary evaluated. According to the Lost River Final Environmental Impact Statement (FEIS), development of the mineral deposits is anticipated to have little adverse effect on water quality or the environment. To accomplish this, effluents from ore processing operations of the proposed mine would need to be contained temporarily in tailings ponds and then piped to sea. Tailings dams would be needed to prevent floods from overflowing the ponds. After discharge in the ocean, wind and waves are anticipated to rapidly disperse effluent containing fine, suspended limestone particles. Vigilant monitoring of marine areas will be needed to ensure that the habitat and living resources were not being harmed by such discharge (DOI 1976). Construction activities associated with this project were also recognized as a potential cause of water quality degradation from erosion and sedimentation. If developers mitigate potential water quality problems as outlined in the FEIS, overall water quality changes resulting from mining Lost River deposits could be expected to be insignificant (DOI 1976). The effects of other major hardrock mining projects in the Bering Straits Region would vary depending on the geology of the area, drainage patterns, mining technique, construction methods, use of mitigative measures, monitoring, and other site-specific factors.

7.5.5 Strip Mining

Coal is the resource most frequently obtained by strip mining. Coal deposits are scattered throughout the region (Volume 1, Map 6) but do not appear to be of sufficient quantity or quality to warrant large-scale extraction. Small-scale localized mining or domestic use could potentially occur. Uncontrolled coal mining could lead to major water quality problems, including severe turbidity and sedimentation, acid drainage, and high levels of inorganic compounds and heavy metals (Kolankiewicz 1982). The severity of these problems would depend on such factors as mining practices, climate, terrain, hydrology, erodibility of overburden, revegetation potential, levels of pyritic sulfur and metals in the coal and overburden, and degree of compliance with water quality regulations. Among the most severe potential consequences of coal mining pollution is the creation of sulfuric acid from oxidation of pyrite or iron disulfide contained in coal deposits. Sulfuric acid from coal mines entering drainages has destroyed aquatic life in thousands of miles of streams in lower 48 coal mining states (96th U.S. Congress, House Report 218, Legislative History on Surface Mining Control and Reclamation Act, Pages 109-113, 134).

7.6 POTENTIAL ENVIRONMENTAL EFFECTS OF MINING

The environmental effects of mineral development vary significantly according to site and type of extraction method used. Examples of mining effects discussed in this section are intended to indicate what could occur as a result of mineral development. The majority of adverse environmental effects of mineral development can be alleviated or minimized through proper planning and use of state-of-the-art technology and operating procedures. Implementation of prudent safeguards for mineral development would be of benefit to the region's residents, habitats, and the associated renewable resources. Guidelines for minimizing disturbance to sensitive wildlife species and use areas are presented in Table 7-1.

7.6.1 Maintenance of Water Quality

The region's streams typically are pristine, clear, and have low levels of suspended solids, turbidity, and nutrients. Without adequate precautions and monitoring, mineral development has the potential for lowering water quality through erosion, sedimentation, and turbidity (Kolankiewicz 1982) or as a result of fuel or chemical spills, sewage effluent discharges, or discharge of processing waters containing toxic materials.

7.6.2 Maintenance of Air Quality

Ambient air quality in the region is excellent. From a regional perspective, pollutants tend to disperse very rapidly (DOI 1976). Large-scale mining operations (e.g., lode mines) could degrade air quality in areas with poor local air circulation. Prudent siting and appropriate treatment of emissions could minimize these problems. Vehicle emissions associated with mineral development are projected to be minimal, but should be monitored to ensure that localized air quality is not degraded.

TABLE 7-1:
MINIMIZING HUMAN ACTIVITY[a] NEAR SENSITIVE SPECIES WHEN THEY ARE MOST VULNERABLE TO NOISE AND DISTURBANCE

	Buffer Radius (Miles)				
Species	**Aerial**	**Surface**	**Permanent Facility to**	**Time Period**	**Source**
Peregrine Falcon nest site	1 1,500 ft. vertical	1	2[c]	15 Apr - 31 Aug	USFWS 1982
Other raptor nest sites	0.25 1,000 ft. vertical	0.25	0.5	15 Feb - 15 Aug	Mindell 1983
Tundra swan nesting area	-[d]	-	4	15 May - 30 Jun	Barry & Spencer 1976 Starr et al. 1981
Black brant nesting area	2	-	-	15 May - 15 Jul	USDI 1978 Starr et al. 1981
Other waterfowl nesting areas	1.5 400 ft. vertical	-	1.5	15 May - 15 Jul	Barry & Spencer 1976 Sellers 1979 Starr et al. 1981
Goose staging and molting areas	2 5,000 ft. vertical	-	-	1 Apr - 30 May 15 Jun - 30 Sep	Derksen et al. 1979 Starr et al. 1981
Seabird colony	1 1,500 ft. vertical	-	-	1 May - 30 Sep	Starr et al. 1981
Pacific walrus haulout	1.5 2,000 ft. vertical	-	-	1 May - 31 Dec	Salter 1979 Starr et al. 1981 Fay 1982
Spotted seal haulout	1.5 1,500 ft. vertical	-	-	15 May - 30 Nov	Johnson 1976 Starr et al. 1981
Bowhead whale spring migration (in ice leads)	1,000 ft. vertical	-	-	1 Apr - 30 May	Fraker 1979 Starr et al. 1981
Belukha whale calving and concentration areas in shallow water (less than 6 ft.)	1,500 ft. vertical	1.5[e]	-	20 Apr - 30 Oct	Fraker 1977, 1979 Fraker et al. 1978 Starr et al. 1981

a. Human activity refers primarily to the increased disturbances to wildlife resulting from major resource exploration, extraction, and related activities. Disturbances resulting from scientific research and management or the legal pursuit of wildlife for sport or subsistence should not be restricted.

b. As defined by Mindell (1983) aerial includes both fixed-wing aircraft and helicopters, even though helicopters are generally observed to be more disturbing at a given distance. Surface includes short-term, reconnaissance-type activities involving few people and limited equipment or noise as well as more intensive disturbances with significant surface alteration, equipment, or noise. Permanent facility refers to structures where frequent vehicular or human activity and noise would occur.

c. Alteration of "limited high-quality habitat" which could significantly reduce prey availability should be prohibited within 15 miles of nest site.

d. Species are sensitive to these disturbances but distances are either unknown or observations are conflicting. Permanent facilities and surface activities which generate loud and frequent noise should be prohibited at least within the buffer zone considered necessary to minimize aerial disturbances.

e. Distance from motorized vessel

Dust created by vehicles and mining operations can damage vegetation and alter snowmelt timing and patterns. Studies along the North Slope Haul Road (Dalton Highway) have shown that road dust can accumulate on vegetation up to a thousand feet from the road. Vegetation which acts as an important insulative cover over permafrost can be damaged or killed by dust accumulation. Loss of vegetation over permafrost can result in thermal and hydrologic erosion as well as habitat loss. Special care should be taken to reduce dust levels attributable to mining activities near populated areas and sensitive habitats (DOI 1976).

7.6.3 Habitat Alteration

Mining can alter habitats. However, the degree of environmental seriousness is largely dependent on the size of the operation, the productivity of the area, procedures and processes used, and monitoring. Mineral development usually involves restricted surface acreage, so the areal extent of direct habitat loss can usually be constrained. Where mining activities impact important riparian and instream habitats (such as in placer mining and gravel extraction), the impacts can be significant even though the area of disturbance is limited.

Carefully located mining operations which use proper safeguards and minimize unnecessary habitat alteration can minimize environmental damage; however, mineral extraction locations are essentially dictated by the location of the deposit. Mining operations in sensitive habitats can cause serious damage. For example, placer operations which do not meet water quality standards can seriously degrade streams and greatly lower their productivity (Woodward-Clyde, 1980). Placer and in-stream sand and gravel extraction can destroy vital spawning areas and overwintering areas, thereby lowering stream productivity for resident and anadromous fish. Indiscriminate removal of material from barrier islands has led to loss of the entire barrier island and lagoon system (DOI 1985a). Offshore dredging in productive habitats (e.g., eel grass beds, spawning substrates, estuaries, lagoons) can also have serious consequences. Due to the potential for damage, mining should avoid sensitive habitats or proceed only with adequate safeguards.

7.6.4 Effects on Anadromous and Freshwater Fish

Damage to the aquatic environment from onshore mining and associated construction can result from increased turbidity and sediment load, decreased levels of dissolved oxygen, and introduction of toxic substances. In-stream extraction activities can cause direct habitat loss as well as a reduction in water quality. Sedimentation can damage spawning beds far downstream from mine or excavation sites and kill plants, algae, and invertebrates fundamental to the food chain (ADF&G 1983). Turbidity can be transported for significant distances downstream from the site of introduction, thereby carrying its impact to aquatic habitat well removed from the mining area.

Fish are especially vulnerable to poor water quality during early developmental stages and as adults when migrating and spawning. Excessive turbidity, suspended solids, and destruction of stream habitat will lower stream productivity and reduce fish populations at all life stages. Turbidity and sedimentation can decrease oxygen levels in spawning beds and result in high egg mortality, stunted growth, and increased incidence of deformities (Silver et al. 1963). Sedimentation can even prevent the emergence of fry from the incubating stream gravels (Koski 1972). Egg mortality of 85 percent has been documented when 15 to 20 percent of the intragravel voids in spawning beds are filled with sediment (Bell 1973). Sedimentation of gravel containing silver (coho) salmon eggs reduced egg-to-fry survival, which is 10 to 30 percent under normal conditions, to about 1 percent. A 5 percent increase in sediments smaller than 0.83 mm in diameter has been shown to cause a 19 percent decrease in fry emergence.

A comparison of a placer-mined fork of a stream and an unmined fork demonstrated that in the mined stream oxygen demand, settleable and suspended solids, and turbidity were much higher, algae and invertebrates were scarce, and fish were apparently nonexistent (La Perrier 1983). When fish from the unmined stream were introduced into the mined fork, gill damage occurred within 24 hours, and the fish slowly began to starve. Sediments may remain in pools for several years before adequate flushing (floods) returns the pools to their former level of productivity (Hall and McKay 1983).

In addition to problems with sedimentation and lowered water quality, in-stream dredging and placer mining physically removes productive habitats. Tailings returned to the stream and piled along streambanks are nearly sterile. Often, nothing remains for vegetation to root in and it may take many years for streamside vegetation to reestablish itself. Loose, uncompacted tailings and mined streambeds tend to lower the water table and increase subterranean flow (Woodward-Clyde 1980). This typically results in water freezing deep into the streambed and a general lowering of water temperatures year-round, both of which impair or preclude successful fish spawning. When ice freezes down to an impermeable surface waterflow is often forced to the surface where it freezes. The resulting ice flow will generally not melt until early summer. Meanwhile, available meltwater runoff would remain below optimum temperature for grayling spawning. It can take many years for a mined section of a Seward Peninsula stream to establish a new channel and regain former productivity (Townsend, personal communication, Woodward-Clyde 1980).

To prevent damage to fish and fish habitat, any structures that might affect anadromous streams must first be reviewed and approved by ADF&G before a state permit will be issued. The U.S. Fish and Wildlife Service issues special use permits for activities on refuges (National Wildlife Refuge Administration Act, 1966; Alaska National Lands Conservation Act of 1980). Additionally, in accordance with the Fish and Wildlife Coordination Act of 1972, the U.S. Fish and Wildlife Service performs advisory reviews of Corps of Engineers Section 404 permits and Environmental Protection Agency NPDES permits. Enforcement of existing federal and state water quality regulations is another method for providing a degree of protection for fish and wildlife.

7.6.5 Effects on Marine Fish and Shellfish

Golovnin Bay, Imuruk Basin, and the Bluff and Nome areas have been considered for offshore gold dredging. Golovnin Bay and Imuruk Basin support large populations of herring. All other areas seasonally support significant anadromous fish populations as well.

Direct seabed alteration or destruction caused by dredging can adversely affect aquatic life in the surrounding area as well as increase turbidity and sedimentation which can influence the local food chain, including fish and shellfish in the surrounding area. Dredging destroys clams and other sessile marine life in the excavated area and degrades or destroy habitats such as herring and capelin spawning areas. Sessile organisms are sensitive to extreme turbidity levels and are unable to avoid being smothered in areas of heavy sedimentation. Areas with high benthic productivity need to be considered when evaluating sites for offshore mining.

Subsistence activities of local residents includes gathering clams, crabs, mussels, seaweed, and kelp from productive areas. Walrus and bearded seals (oogruk), major subsistence resources, feed on clams. A substantial loss of clams and other invertebrates along the coast could result in changes in feeding areas for walrus and bearded seal populations. Herring depend on kelp and eelgrass for the successful completion of their life cycle. Salmon and seals are dependent on herring as a food. Ultimately, village residents depend on marine fish and shellfish which provide forage for major subsistence resources.

7.6.6 Effects on Marine Mammals

Unless dredging or mining activities occur in or near migration routes, haulouts, rookeries, or feeding areas, the primary effect of mining on marine mammals would be their active avoidance of coastal areas where mining or related activities are occurring. Areas especially susceptible to avoidance are those where noise is detectable underwater. As previously noted, dredging which destroys marine vegetation, clams, and other invertebrates could affect walrus, bearded seals, and other marine mammals which depend on these resources for a major part of their diet.

Most offshore dredging and construction and peak marine vessel traffic can be anticipated to occur from July to September when walrus and seals are least abundant in Norton Sound. Marine mammals present during spring and late fall migrations and those summering in the region (belukha and gray whales) could be adversely affected. A port servicing major development activities would be icebound during winter and spring when marine mammals generally are harvested. Use of icebreakers and aircraft have the potential for disturbing marine mammals and reducing marine mammals populations and subsistence harvests. Mitigation measures to be considered should include restriction of vessel and airplane traffic during periods when it might affect subsistence hunting or marine mammal migrations, breeding, rearing, or feeding.

7.6.7 Effects on Land Mammals

While increased human population resulting from mineral development can have a significant impact on upland mammals, long-term impacts are difficult to quantify. Animal responses to environmental changes differ by species. Generally, the response to habitat disturbance is to relocate, provided suitable alternative habitats are available and the carrying capacity of the habitats is not exceeded. Those that remain would be vulnerable to further disturbance or hunting by residents of new or growing communities. An active transportation corridor might disrupt animal movement patterns. Although shifts in animal distribution might seriously reduce subsistence harvests, improved access would benefit hunters as long as game populations were not seriously depleted.

Several large land mammals inhabit the region. Moose have become widespread since their reintroduction 20 to 30 years ago. Moose are generally tolerant of minor disturbances, and they have shown some ability to accommodate changes in their environment. Nevertheless, significant habitat loss, especially essential wintering and breeding areas, could result in population decreases for this species. Increased mortality due to vehicle collisions and hunting could be locally significant.

Caribou of the Arctic herd occasionally winter along the eastern Norton Sound coast and inland toward the Yukon River. The Andreafsky herd (about 3,000 animals) ranges in the same area (Volume 1, Map 10). An estimated 30,000 caribou from the Arctic herd have wintered on the eastern Seward Peninsula east of the Koyuk River in recent years (Anderson, ADF&G, personal communication). Most of the suitable caribou range on the Seward Peninsula is used for reindeer herding. Caribou entering a reindeer range are considered reindeer and become the property of the herder.

Caribou, particularly cows with calves, are sensitive to disturbance (Starr, et al. 1981). Reindeer herds are widespread, grazing throughout the heavily mineralized Seward Peninsula. Development activities within or adjacent to important habitats (wintering and fawning areas) and migration routes can have a serious impact on the viability of affected herds (Chapter 4).

Musk-ox, introduced into the region in 1970, generally inhabit coastal lowlands along the western Seward Peninsula (Volume 1, Map 10). They may relocate in response to disturbance, but population levels probably would not be adversely affected unless calving areas were disturbed between March through May (Zimmerman 1982).

Increased hunting pressure and disturbance could reduce the grizzly bear population. Bears would likely relocate to avoid heavily traveled roads or construction and operation of mining projects, particularly if disturbance occurs near denning areas. Direct loss of important habitats for grizzly bears could lead to reduction or displacement of some animals. Bears also could be adversely affected if their travel patterns to and from feeding and denning areas were disrupted. Human/bear conflicts would likely increase in the event of large-scale mineral development and could result in the death or injury of bears or people.

7.6.8 Effects on Birds

The region supports a diverse and seasonally-abundant bird population. Development activities can adversely affect birds by destroying habitat and by imposing increased visual and noise disturbances to their essential use habitats, particularly along transportation corridors (Dames and Moore 1980). Migratory waterfowl, seabirds, or shorebirds have been noted to flee critical feeding, nesting, or staging areas in response to low-flying aircraft (Starr, et al. 1981). Noise from nearby offshore dredging or other activity might also initiate the flight response. Prolonged or startling disturbances could cause birds to abandon nests containing eggs or young, or in the case of cliff nesting birds, accidently knock their young off the cliffs (Starr, et al. 1981).

Dredging of barrier islands can result in destruction of lagoons. This would amount to a significant loss for birds which extensively use these lagoons, barrier islands, and associated wetlands.

Chapter 8: Transportation

8.1 ISSUES AND CONCERNS

Major issues and concerns are the:

- economic, social, and environmental effects of expanding regional transportation; and
- effects of expanding regional transportation on fish and wildlife and subsistence resources and harvests.

The transportation system in the Bering Straits CRSA is still in an early stage of development. While there is limited road access to only three of the region's villages, all villages can be reached (weather permitting) either by plane or boat, depending upon the season. Airplanes carry most passengers and freight, and barges carry bulk freight and fuel. Expansion of the transportation system to accommodate resource development or improve access would have both positive and adverse aspects, some of which are discussed in this section.

8.2 TRANSPORTATION NEEDS

Villages often place improvement of airports (navigational aids, lights, terminal buildings, restrooms, longer runways, and improved runway surfaces) on their community development priority lists. Most of the region's runways are short and can only accommodate small aircraft. This impedes incoming freight delivery and outgoing shipments of fish and reindeer to commercial markets. The majority of regional runways are unpaved, which can be hazardous when wet and soft. Villagers also cite the need for improved barge service and lower transportation costs. Large draft vessels must either lighten freight onshore, using smaller shallow-draft boats, or unload in Nome, a regional distribution center, and distribute to shallow draft tugs and barges for delivery to specific villages. One village, St. Michaels, has a suitable harbor.

While a few villages would like new local roads, the majority of the villages do not want direct road access to Nome, Kotzebue, Fairbanks, or Anchorage. Some Wales residents want to have a road built between Wales and Tin City which would enable residents to take advantage of the deeper water that allows direct barge service to Tin City. The Six-Year Plan of the Department of Transportation and Public Facilities indicates that Gambell-Savoonga, Teller-Wales, Stebbins-St. Michael, Kaltag-Unalakleet, Elim-Elim Hot Springs, and Wales-Tin City would like road connections. Other transporation improvements listed in the Six-Year Plan include local streets and access roads in several villages, and reconstruction and realignment of portions of the Nome-Council road.

8.3 FACILITIES NEEDED FOR RESOURCE DEVELOPMENT

Transportation facilities which might be required for regional resource development include ports, short-haul roads, railroads, airstrips, pipelines, and utility corridors. Any large mining or oil and gas development would require a port. Shallow waters along most of the region's coast limit potential port sites to a few locations. Port development might be feasible at Port Clarence, Cape Nome, Cape Darby, and Grantley Harbor. The potential of other sites has yet to be explored. The Nome port consists of a 3,100-foot dock and causeway extending seaward to a depth of about 25 feet. The facility serves as a general cargo port with no provisions for bulk load handling by railroad or conveyor (Holder, City of Nome, personal communication).

Getting material (ore or ore concentrate) from a mine to a port would necessitate construction of roads or railroads, most of which probably would be 50 miles or less in length. A proposed (but unlikely) railroad linking the Ambler mining district with Cape Darby, however, would be considerably longer (Louis Berger and Associates 1980).

Petroleum development in Norton Sound or Hope Basin would most likely require a pipeline system consisting of connector lines feeding into a central transmission line carrying oil to storage tanks at an onshore terminal. Docks and other facilities would be needed to accommodate oil tankers which would carry the oil to markets or processing facilities outside the region. Air traffic would increase as a result of either petroleum or mining development. This would result in increased use of some existing airports and landing strips, and it might require construction of new airstrips at mine sites, terminals, ports, or at communities where workers were housed.

Utility corridors and new generating facilities (e.g. a new hydroelectric plant) could be required to provide power to major mining or oil and gas operations.

8.4 POTENTIAL EFFECTS OF AN EXPANDED TRANSPORTATION SYSTEM

Expansion and improvement of the region's transportation system would have both advantages and disadvantages. Actual effects would depend on such variables as facility, location, environmental conditions, sensitivity of habitats and wildlife present, type and extent of human use of the area, and operational considerations. The following sections of this chapter discuss factors that should be considered prior to constructing new transportation system components.

8.4.1 Subsistence Access

New roads and trails could reduce travel time from villages to hunting, fishing, and gathering areas and extend the range of subsistence use. Some traditional use areas, however, might receive greater pressure from subsistence, sport, and recreational users as a result of improved access. In some instances, fish, wildlife and plant populations could be significantly reduced due to improved accessibility.

8.4.2 Recreation

Improved access (trails, roads, airstrips) could enhance or provide additional opportunities for recreational activities. However, the unique wilderness experience of some recreational activities could be impaired by the presence of transporation facilities.

8.4.3 Economies in Freight Movement

The more frequently an item must be handled or transferred from one type of carrier to another, the more expensive associated shipping costs become. Theoretically, improvements in ports, airstrips, and transportation service would allow more direct shipment and lower cost. For example, goods flown or barged to a village directly from Anchorage or their point of origin should be cheaper than the same goods transshipped through Nome (or Unalakleet). A deepwater port would reduce shipping time, eliminate local lighterage costs, and might result in larger bulk shipments, all of which could reduce the cost of goods. A road linking a port to villages could serve to reduce the cost of getting goods to villages.

8.4.4 Emergency Response

Speed is a critical element in emergency response. Air service is fastest, but roads that connect medical facilities to outlying villages provide a critical alternative when weather conditions preclude flying.

8.4.5 Reduced Isolation

New or upgraded roads and airstrips or expansion of local transportation services would encourage increased interaction with other areas in the Bering Straits Region. Though not everyone would welcome this, increased accessibility could result in an expanded knowledge of the region, stronger bonds with other communities and the larger society, and perhaps improve educational and economic opportunities.

8.4.6 Vessel Traffic

Increased deep-draft vessel traffic, particularly oil tankers, increases the risk of a serious accident. First and foremost is the threat of oil or other hazardous material spills. Such spills could reduce wildlife populations, as well as damage the marine food chain (DOI 1982, 1985a). Consequently, the regional economy, subsistence, sport hunting/fishing, and recreation could all be affected.

Another potential ramification of increased vessel traffic, especially if the shipping season is extended through the use of icebreakers, is disturbance to marine mammals. Vessel traffic in ice leads might disturb polar bears, whales, seals, walruses, and seabirds, particularly during spring when traffic would disrupt migrating whales and breeding seals and walruses. Artificial leads created by icebreakers could change migration patterns, which might ultimately affect subsistence hunting (Louis Berger and Associates 1981). Birds or mammals using artificial leads would be very vulnerable to disturbance or contamination caused by vessel traffic.

8.4.7 Altered Water Circulation

Structures which extend from the shoreline or alter shoreline configuration could change water circulation patterns. Though sea ice limits use of breakwaters along much of the Bering Sea coast, breakwaters may be feasible under certain circumstances. Residual oil from boats and other sources could build up on the breakwater, creating an eyesore and possible health hazard. Shifts in sediment transport along the coast (littoral drift) can occur due to development activities. Interruption of littoral drift could result in either the disappearance of beaches and barrier islands which exist because of the sediment flow, or in the creation of new breaks and passages in barrier islands. Development activities can cause outmigrating salmon fry to be forced to travel through deeper water to pass an obstruction extending from the shore, thus increasing the risk to predation.

8.4.8 Erosion and Sedimentation

If precautions are not taken, sediment from eroding roadbeds, cuts, and fills can be carried into streams and rivers, suspended in the current, and deposited throughout the downstream portions of the stream. In some cases extensive silt deposition might result in stream braiding. Fish, particularly in the egg, alevin, fry, and smolt stages, can be adversely affected by turbidity and sedimentation. Sediment deposition can render gravel streambeds unusable for spawning, and if eggs have already been deposited, sediment can smother them. Excessive turbidity could reduce the dissolved oxygen content of the waterbody, which would adversely affect fish and other aquatic life. Lower water quality could result in reduction of aquatic vegetation and lower levels of zooplankton species, both of which would affect the entire food chain and lower overall productivity of affected portions of the stream. Reduction or elimination of a stream's fish population could affect the local commercial fisheries, subsistence, and sport fisheries.

8.4.9 Habitat Loss

Construction of ports, terminals, airstrips, roads, pipelines, and utility corridors results in direct loss of wildlife habitat. Noise, activity, and disruption around these areas can further displace wildlife. Roads, pipelines, and utility corridors which intersect migration routes could impede migrations and discourage use of some habitats. Powerlines in areas heavily used by birds could cause significant bird mortality; this is of particular concern where power lines may be located along intensively used migration corridors for waterfowl.

8.4.10 Natural Hazards

Unless situated well inland, roads and utility corridors are susceptible to repeated exposure to coastal flooding and erosion. Roads subjected to this type of natural hazard require extensive and expensive reinforcement, stabilization, and maintenance.

8.4.11 Noise

Traffic noise can disturb sensitive wildlife species, causing them to avoid the area of disturbance (Starr et *al.* 1981). Care must be taken to avoid sensitive habitats, such as those supporting caribou calving, bear denning, and bird-nesting. Similarly, noise at sea (e.g., from vessels or aircraft) could affect marine mammal migrations or distribution. Nesting seabirds are particularly vulnerable to loud or sudden noises (Starr et *al.* 1981). Aircraft noise, particularly that of helicopters, can disrupt birds and other wildlife and even cause gradual population declines in some species sensitive to disturbance (e.g., seabird colonies and seal and walrus in haulout areas).

8.4.12 Material Extraction, Thaw Collapse, and Drainage

Road and airstrip construction usually requires quarrying and borrow sites. Where material extraction requires removal of vegetation, greater solar penetration can cause deeper thawing. Overflow from ponds formed by thaw water can cause local flooding and erosion (NPRA 1979). This type of hazard often occurs in or near villages as a result of road and airport construction.

8.4.13 Dust

Dust blowing from the exposed gravel surfaces of roads or airstrips can adversely affect vegetation in the immediate area. Under certain conditions, blowing dust could affect the chronology of snowmelt, nearby water quality, and possibly the plant succession of the affected area. In village or subsistence camps, blowing dust is at best annoying and often precludes proper preparation of harvested subsistense resources. Under extreme conditions, blowing dust can be a safety hazard to aircraft.

8.5 METHODS FOR MINIMIZING IMPACTS

- Culverts, where necessary, should be sized and installed in accordance with Alaska Department of Fish and Game standards that provide for upstream and downstream passage of fish.

- Require transportation and utility corridors in wetlands to provide adequate cross drainage, even when defined channels are not present.

- Site gravel pits away from communities and vantage points.

Chapter 9: Commercial Fishing

9.1 ISSUES AND CONCERNS

Major issues and concerns are the:

- effects of oil and gas development on regional fisheries;
- effects of mining, particularly in-stream gravel and placer mining on salmon fisheries;
- environmental effects of seafood processing;
- use of salmon aquaculture to increase salmon stocks and harvests;
- effects of commercial fishing on fish stocks and subsistence harvests; and
- level of local participation in regional fisheries.

The State of Alaska manages commercial fisheries to achieve a sustained harvest. Toward that end, the Board of Fisheries, in consultation with local advisory boards, establishes fishing periods and harvest quotas to help perpetuate long-term resource abundance and insure the health of the industry. Commercial fishing districts in the region are shown on Map 9-1. Norton Sound supports commercial salmon, herring, and king crab fisheries with a total annual value of 2.3 to 3 million dollars (see Volume 1, Commercial Fishing). While subsistence fishing is the foundation of many Norton Sound villages' subsistence economies, commercial fishing provides most of the annual income for many Norton Sound residents. Therefore, protecton and prudent management of fish stocks is crucial to local and regional subsistence and cash economies.

Herring catches appear to be at or near the maximum sustainable harvest (about 20 percent of available fish), but salmon fisheries may be able to support an increased catch of as much as 400 metric tons (880,000 lbs) above the current level of 700 metric tons (1.6 million lbs) (DOI 1982). Salmon and herring runs, however, often vary dramatically from year to year and may greatly exceed or fall short of these estimates. The region's relatively small king crab fishery, which has declined recently, probably will not increase significantly in coming years. Offshore crab fisheries require large boats, and local participation does not appear economically feasible. Each spring a small number of Nome residents commercially take small quantities of crab through the ice near town and sell them locally. Trawl surveys in 1976 revealed that the region's waters contain millions of large sea snails. Approximately 71 million *Neptunea Heros* with a biomass of 14,500 metric tons (31,900,000 lbs), accounted for half of the snails in the survey (Wolotira 1977).

9.2.1 Effects on Subsistence and Sport Fisheries

If the state prudently manages commercial fisheries, catches should not detract from subsistence or recreational harvests. Overharvests, however, could result in poor commercial, subsistence, and sport catches for several years or longer if the fishery was not allowed to recover. The state gives harvest priority to subsistence users. Consequently, if it became evident that runs might not be large enough to meet subsistence and escapement needs, the state would, as appropriate, close commercial and recreational fisheries by emergency order. For example, in recent years commercial crab harvests significantly reduced the subsistence catch in Golovnin Bay. Consequently, to protect subsistence harvests, the state restricted commercial fishing in these nearshore waters.

9.2.2 Local Participation in the Fisheries

Norton Sound has a limited-entry commercial salmon fishery for which the state has issued 192 permits. Regional residents hold approximately 90 (47%) of them. Commercial herring and crab fishing do not require limited entry permits. To increase local participation in the herring fishery, the State closed the fishery to purse seiners from outside the region who had been taking most of the catch. Fishermen from outside the region using larger boats (32-foot) and modern gear still account for a disproportionately large share of the salmon and herring catch. Regional residents lack the large boats and gear necessary to participate in offshore crab fisheries. However, a few Unalakleet residents have begun to use larger aluminum boats in hopes of increasing their success. An aluminum boat builder in Unalakleet is finding an increasing local market for competitive aluminum commercial fishing boats.

The Norton Sound Fishermen's Association (NSFA) and Kawerak, Inc., established a limited program to train local residents in boat building, net repair, and other commercial fishing skills. If a self-sustaining program could be established, it would greatly benefit local fishermen. The potential for increasing local salmon harvests is limited not only by the availability of good equipment and training, but also by the cost and limited availability of fishing permits ($10,000 to $12,000). Some people fish for herring in an attempt to earn enough money to purchase a salmon permit.

Onshore processing plants provide a limited number of seasonal local jobs. These plants must compete with the dozen or more floating processors which operate in Norton sound during the course of the salmon and herring seasons. To succeed, onshore facilities which depend on large quantities of fresh or salt water and electricity require the support of local fishermen and the community. Onshore processing plants currently need new docks, dry storage, and boat repair facilities to remain competitive. Local commercial participation by residents in other existing or potential fisheries (e.g., crab, snails) would probably require large capital investments for bigger boats, gear, and suitable harbor and processing facilities. These high levels of investment often preclude local entry into the fishery.

9.2.3 Effects of Resource Development on Regional Fisheries

Oil and gas development, residential development, and various types of mining could degrade salmon spawning and rearing habitats and reduce salmon stocks. Oil could kill king crab and herring eggs and larvae if contacted, and depending on the extent of contact, could cause a serious decline in commercial and subsistence fisheries. Drilling rigs, pipelines, and increased marine traffic can interfere with commercial fishing. Trawling and crabbing might be prohibited along pipeline corridors where gear might get hung up or lost. Oil slicks, decomposing crude oil, and discharges from passing vessels might foul fishing gear. Some commercial fish and shellfish stocks, once tainted by oil pollution, would be difficult or impossible to market. The oil, gas, and mining sections of this volume describe in detail the effects of each type of resource development on fish and shellfish.

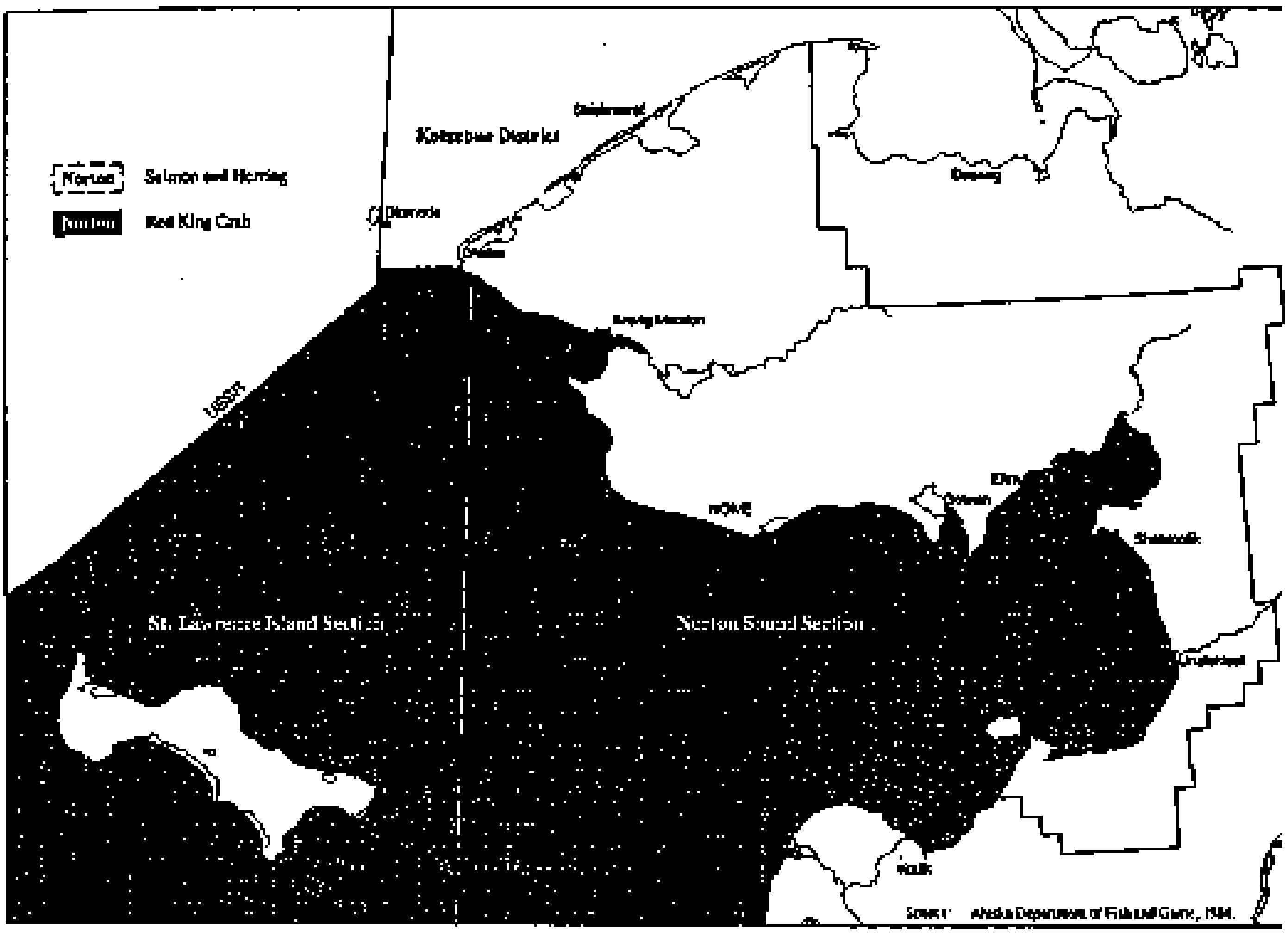
9.2.4 Conflicts with Commercial Fishing

Oil spills pose the greatest threat to the region's fisheries. Herring or salmon spawning areas (intertidal), migration routes, and areas containing king crab or cod eggs or larvae would be at the greatest risk. Oil settling to the bottom could also affect bottom-dwelling species. Depletion of salmon or herring stocks as a result of oil-related activities would have serious ramifications for fishing villages along Norton Sound. Villagers who depend on commercial fishing and seafood processing plants would find it difficult to cover their operating costs, while providing for basic necessities. Problems would be compounded if subsistence harvests were also significantly diminished.

Within the Bering Straits Region, herring have the greatest vulnerability to oil pollution, and much of a single year's production could be lost in the event of an oil spill (Barton 1978). King crab stocks could also incur substantial losses

Map 9-1

COMMERCIAL FISHING DISTRICTS



In addition to direct losses, spilled oil could taint fish and shellfish, rendering them inedible or unmarketable (Starr et al. 1981). If fisheries were forced to close, fishermen and processors would bear economic losses. Fish and shellfish could be contaminated either by direct contact with oil or by ingestion of oil-tainted prey. They could also be fouled in holding tanks of vessels requiring circulating seawater (crab boats and processors) which operate in contaminated waters.

9.3 AQUACULTURE

Regional interest has been expressed in rearing silver salmon to enhance the commercial fishing industry for this species. Low-value pink salmon currently comprise most of the commercial catch. Silver salmon must be reared for approximately two years prior to release, which could be a very expensive and difficult proposition in much of the region. Such a project, however, might be feasible at Pilgrim Hot Springs, where hot springs might be used to warm hatchery water. This would enhance growth rates and reduce hatchery operating costs. Hatcheries require a constant, dependable, supply of pure water. Water needed for a hatchery could lower water levels downstream to the extent that natural aquatic life is adversely affected. Likewise, discharges from a hatchery could degrade productive water bodies. Hatcheries sometimes produce diseased or genetically inferior fish that can weaken the region's healthy wild salmon stocks if they are allowed to interbreed.

9.4 ENVIRONMENTAL EFFECTS OF SEAFOOD PROCESSING

Shore-based processing plants at Unalakleet, Golovin, and Moses Point, and several floating processors anchored offshore, process most of the Norton Sound catch. Processors use large volumes of fresh and salt water, which potentially could tax local water supplies or draw-down freshwater bodies to the extent that aquatic life is adversely affected. Processors discard large quantities of organic wastes (e.g., blood, entrails, bone, skin, heads, scales, oil, shells, and meat), grease, and dirt into marine waters. Generally biodegradable (though slowly in these cold waters), these processing wastes can deplete the water's oxygen as they decompose, thereby diminishing its suitability as a habitat for fish and other sea life. Ammonia found in most of the discharged waste can also degrade water in the immediate area of discharge. Accumulated wastes can smother clam beds and other benthic life.

Outfall location, currents, and biological conditions in the receiving waters largely determine the effects of discharged fish processing wastes. Outfalls located seaward of tidelands in areas with strong currents or tidal action quickly disperse wastes. If adequate flushing does not occur, foam, surface film, floating debris, and discolored water are evident around the processing plants, creating an eyesore and possible health and safety hazards. Entrails and other wastes can foul water and fishing gear and become a nuisance for both fishermen and people using nearby beachs. Wastes also attract scavengers such as gulls, ravens, and bears (Environmental Analysis Fact *NPDES*, Dec. 1983).

Chapter 10: Outdoor Recreation

10.1 ISSUES AND CONCERNS

Major issues and concerns are whether recreational use will:

- provide economic benefits;
- conflict with private landowner rights;
- reduce wildlife populations used for subsistence purposes; or
- disrupt subsistence activities.

The region is currently experiencing limited but increasing outdoor recreational use. Nonconsumptive outdoor recreation occurs along the Unalakleet River, St. Lawrence Island, and the Bering Sea National Land Bridge Preserve. Most sport fishing occurs along the roads extending from Nome, and in the Unalakleet and Fish Rivers. Sport hunters concentrate on the Imuruk Basin, a few major drainages, and the Stebbins Wetlands. Bird hunters focus on coastal wetlands (Volume 1, Recreation). To date, sport harvests have had limited effects on subsistence harvests. There have been a growing number of minor conflicts between subsistence and sport fishermen occurring on the Unalakleet and Nome Rivers. Since its designation as a Wild and Scenic River, Unalakleet residents are concerned that increased recreational use of the Unalakleet River may lead to further conflicts or interference with subsistence harvests. Sport fishermen occasionally interfere with subsistence activities, though it is doubtful that sport fishermen are having a significant effect on fish populations, given the relatively low level of current effort. If major development occurs, conflicts, and possibly even resource depletion could occur in streams near a developed area.

The region supports large wildlife populations which are primarily harvested for subsistence use. Sport hunting for upland species near villages or heavily-used traditional subsistence hunting areas could result in insufficient local subsistence harvest. To the extent that migration patterns are not disrupted or populations significantly reduced, harvesting in areas remotely distant from villages would probably have little effect on subsistence harvests.

Currently, moose populations appear to be at the upper limits of the carrying capacity of several major drainages, including the Kuzitrin, American, Kougarok, and Agiapuk Rivers (Anderson, ADF&G, personal communication). ADF&G, concerned about moose calf mortality, restricted harvest of calves and cows with calves on the Seward Peninsula during the 1983-1984 season.

Caribou from the Arctic herd have been wintering on the eastern Seward Peninsula, primarily in the Koyuk River area, to within about 10 miles of the coast. ADF&G estimated that 30,000 caribou roamed the area during the winter of 1983-1984 (Anderson, ADF&G, personal communication). Though fewer animals range along the coast between Norton Sound and the Yukon River, even a low level of sport hunting could potentially have a negative effect on subsistence.

10.3 IMPACTS OF DEVELOPMENT ACTIVITIES

Areas most likely to be affected by increased recreational use resulting from oil and gas development and associated population increases are located along the southern side of the Seward Peninsula where oil terminals, housing, pipelines, and roads might be built, and along the road system to Nome. Workers at a major mining complex would most likely recreate in the vicinity of the camp. Although many would commute from outside the region, some oil field workers and miners could be expected to travel by air throughout the region to hunt and fish during their free time. Increased recreational use could result in construction of legitimate and unauthorized remote airstrips, cabins, lodges, and camps which could conflict with existing uses.

Given the abundance of waterfowl, sport harvests probably would not affect the subsistence take or noticeably deplete bird populations in most areas; however, aircraft used for sport hunting can disturb waterfowl and might therefore reduce subsistence harvests.

In addition to increased demand for fish and game, both oil and gas development and mining can cause environmental damage and reduce wildlife populations available to recreational and subsistence hunters and fishermen.

10.4 ECONOMIC BENEFITS

Most tourist dollars are spent in the Nome area, but sale of ivory carvings and other crafts to visitors provides significant income for many village families. The Savoonga Walrus Festival and bird-watching tours attract visitors to St. Lawrence Island which benefits local ivory carvers. Tourism and recreational hunting and fishing also provide business for transportation and charter services.

Two of the region's sport fishing lodges - Camp Bendeleben and Silvertip Lodge - provide little regional or local economic benefit other than regional transportation services. Silvertip Lodge hires its guides and other staff from outside the region. Visitors spend very little time and money in nearby Unalakleet when they enter and depart the region. The third regional fishing lodge - White Mountain Fishing Lodge - is community-owned and operated and depends on local hire for labor and services.

Currently, a few local guides lead hunts for grizzly bear, moose, and waterfowl, but work is seasonal and often sporadic. If the federal government returns marine mammal management to the state, sport hunting of polar bears, walrus, and seals will likely resume. Between 1976 and 1979, when marine mammal sport hunting was allowed, local residents and other guides received about $5,000 per hunt. Local guides are less likely to interfere with subsistence activities or harvests. Guides from outside the region provide little economic benefit to the region and are more likely to interfere with subsistence harvests. Expansion of recreational use of the region is dependent upon avoiding conflicts with subsistence and maintaining the region's wilderness character, wildlife populations, and access to recreational areas.

Chapter 11: Land Ownership And Management

11.1 ISSUES AND CONCERNS

Major issues and concerns are the:

- effects of land ownership patterns and land management plans on resource use;
- coordination of regional land management;
- implications of 1991 when Native corporations may sell their stock and tax exemptions expire; and
- effects of trespass and unauthorized entry on Native Lands.

As a result of such major land legislation in recent years as the Alaska Native Claims Settlement Act (ANCSA), Alaska National Interest Lands Conservation Act (ANILCA), and selections pursuant to the Alaska Statehood Act, regional land ownership patterns are becoming increasingly complex (Volume 1, Ownership, Management, and Use of Land). Regional and village Native corporations, and state and federal governments each control large parcels scattered throughout the region (Volume 1, Map 5). These changing land ownership patterns and resource management schemes will have a bearing on traditional and potential resource use in the region.

11.2 EFFECTS ON SUBSISTENCE

All the regions' villages have traditional areas where residents hunt, fish, trap, gather plants, berries, and timber, and participate in spiritual activities. Individual families are also recognized as using specific areas. Such usage has traditionally been recognized and respected by other family groups. New boundaries established by a patchwork of federal, state, and Native and other private ownership often interfere with traditional use and create a large potential for intentional and unintentional trespass. In response to this, there is a growing movement for village corporations ad traditional governments to protect their lands from trespass by establishing cooperative use agreements with their counterparts in adjacent villages. Traditional governments are particularly concerned with protecting traditional subsistence use patterns and exercising management jurisdiction over their lands. Village corporations are primarily concerned with protecting shareholder interests by developing land management policies that protect their land from degradation, unauthorized use, trespass, and adverse possession. To protect traditional use in some areas, villages are working with the Federal government to provide for unrestricted use of traditional areas (for subsistence and spiritual activities) within national parks, preserves, and monuments.

11.3 EFFECTS ON RESOURCE DEVELOPMENT

Private individuals, companies, the village corporations of Savoonga, Gambell, Elim, and the Bering Straits Native Corporation (BSNC) have mineral rights (subsurface) to large portions of the region. Surrounding land owners could impede access to some of these mineralized areas or restrict access for oil development. For example, the Bering Land Bridge National Preserve management guidelines do not allow oil and gas development or new mining claims, though existing claims can be worked. The region contains numerous historical sites that are protected from development that would degrade them. In addition to these legislative restrictions, state, federal, and private land owners have management plans or will be developing management plans which will encourage some land and resource uses while restricting others.

11.4 EFFECTS ON REINDEER

Approximately 35,000 reindeer graze in 13 allotments on the Seward Peninsula and near Stebbins (Map 4-1). These animals, which require large expanses for grazing, often migrate between widely separated wintering, fawning, and summering areas. In summer, to escape hordes of insects, reindeer move west toward the coast and its comforting winds. Unaware of allotment boundaries, unattended reindeer may wander into adjoining allotments to the west. As ownership patterns become increasingly complex, landowners might impose use restrictions to directly or indirectly preclude reindeer herding and, thereby, detrimentally affect the availability of reindeer as a vital source of income and meat to residents of the region.

11.5 EFFECTS ON RECREATION

As large parcels of land come under Native corporation ownership, recreational opportunities for nonshareholders may diminish. Village corporations are limiting and charging for access to their land. Conversely, designation of the Unalakleet River as a Wild and Scenic River and establishment of the Bering Land Bridge National Preserve will likely bring an increasing number of visitors to these designated recreational areas. An increase in visitor usage will likely increase the amount of intentional and unintentional trespass on Native lands.

11.6 IMPLICATIONS OF 1991

In 1991 when Native corporation shareholders can sell their stock and corporations lose their tax exempt status, Native residents could begin to lose control of their land. Offers might prove too lucrative for some to pass up, and land could gradually come under control of developers who care little for village values or needs. A variety of options are being explored to ensure continuing Native ownership of Native corporation lands. Such options include placing land in the sheltered Alaska Land Bank created by ANILCA, use of corporate devices (denial of cumulative stockholder voting, conflict of interest restrictions, residency requirements, etc.), use of easements and covenants (pending revision of state law), local land use plans and land use controls (e.g., zoning, performance standards) and possibly giving corporation assests to federally-protected Indian Reorganizaton Act councils (see AFN 1982 for a detailed discussion of these approaches). The Alaska Federation of Natives is a strong advocate for legislation to address concerns regarding 1991 and provide options for permanent Native ownership of land conveyed under ANCSA.

11.7 NEED FOR COORDINATION

To best use the region's coastal resources, and in keeping with local desires and state and national needs, regional lad management must be coordinated. The Bureau of Land Management offices in Fairbanks and Anchorage have each developed plans for land they manage in the region; the Alaska Department of Natural Resources has a general management plan for its land and is developing a detailed Northwest Area Plan; and the Bering Straits Native Corporation has a five-year development plan to guide its resource use. Many of the region's 17 village corporations are also developing land management plans for their extensive holdings, and villages are also developing city land use plans. In addition, all land use and activities on private (excluding Native allotment) and State land within the CRSA boundary must comply with provisions of this coastal management program. Uses and activities on federal land, though not directly subject to coastal management, must be consistent with this program. Consequently, this program can serve as a vehicle to help coordinate regional land management as well as to insure that regional residents' values reflected in this program are considered in land owners' development plans.

11.8 METHODS OF MINIMIZING IMPACTS

- Avoid obstructing or restricting access to traditional use areas;

- Recognize subsistence, reindeer herding, and preservation of essential wildlife habitats as priority land uses;

- Encourage major landowners and managers to coordinate land management and resource development strategies by establishing advisory land management committees;

- Encourage DNR to continue its coordination of planning efforts with the CRSA Board;

- Encourage BLM, DNR, and Native corporations to coordinate with the CRSA Board for potential land disposals or major development activities; and

- Educate and sensitize new residents and visitors to the region of boundaries of Native-owned land, land entry/use requirements, and that unauthorized entry/use is considered trespass.

Chapter 12: New Settlements

12.1 ISSUES AND CONCERNS

Major issues and concerns are the effects of new settlements in remote areas on:

- fish and wildlife habitats; and
- established subsistence and recreational use areas.

New settlements in the region could result from state, federal, and private land disposals, village relocation, or major resource development. Such settlement could disrupt wildlife, create greater demand for fish and game, conflict with subsistence, and create demands for roads, airstrips, community services, and utilities. The initial high cost of establishing utility systems may preclude many new settlements from developing a comprehensive utility system. New settlements also bring noise and disruption, the potential for fuel spills, and direct loss of habitat. Natural hazards (e.g., erosion, flooding, steep slopes) and drainage patterns are often overlooked or ignored when determining site locations. Such oversights often result in flooding, accelerated erosion, or health hazards.

The region supports a variety of soil conditions (Volume 1, Natural Resources). Saturated or unstable soils or high water tables would make building particularly difficult and costly. Maintenance costs can also be high. Without proper preconstruction inspection, an archaeological site could inadvertently be destroyed.

12.2 PROPOSED SETTLEMENT AREAS

The most likely new settlement site in the region is the Pilgrim Hot Springs area. Pilgrim Hot Springs, with its hot springs and geothermal potential, has long been considered a good prospect for new settlement. A road recently built to the area makes development likely. A Nome resident has a long-term lease to develop the springs and surrounding area. The hot springs has potential for heating buildings, including several commercial-size greenhouses, a fish hatchery, and about 200 homes. Mary's Igloo residents living in Teller have expressed interest in returning to their traditional homes in nearby Mary's Igloo, or in relocating to Pilgrim Hot Springs to take advantage of better acces to subsistence resources

New settlements might result in intensive use of previously undisturbed areas. Wildlife sensitive to disturbance in the immediate area could move to less-disturbed areas if suitable habitats are available. Where unique or limited habitats are disturbed, new settlements could preclude use of the area. Increased subsistence and recreational hunting near Pilgrim Hot Springs and along the new road will most likely reduce the area's substantial moose population. Cumulatively, new settlements have a high potential for reducing subsistence harvests of people currently depending on those resources.

The State Department of Natural Resources (DNR) has approval for disposal of recreational homesites along the Pilgrim and Grand Central Rivers. This would be the first state disposal in the region The proposed disposal had support at public meetings in Nome, but not in the outlying communities of Teller and Brevig Mission. Based on unfavorable comment at public meetings in Nome, the State ultimately decided not to sell land near the Sinuk River. State land disposals attract people from within and outside a region, but most settlers already live in the region year-round. Buyers from outside the area usually come seasonally to hunt and fish. The Northwest Area Plan under preparation by DNR will identify other land to be disposed of for settlement.

Shishmaref residents have considered relocating their village to avoid recurring coastal flooding and erosion. If the village is forced to relocate, it would be reestablished in the near vicinity, and subsistence patterns would probably remain much the same. Consequently, a new settlement would have few environmental effects beyond the actual site as long as natural hazards are considered and care is taken in locating fuel tanks, a solid waste site, and other uses and facilities with the potential to degrade the environment. Flooding along the area's coast limits the number of alternative sites for village relocation on village corporation land. Adjoining federal land in the Bering Land Bridge National Monument is not available for settlement.

A major mining operation, such as development of the Lost River deposits, could require a settlement of up to 1,000 peple (DOI 1975) near the mine site and perhaps expansion of existing communities (probably Nome). Oil and gas development of a medium-size find would also require housing and support development for up to 3,200 people (DOI 1982). Most oil field workers would probably be imported from out of state (Weaver 1984) and would reside offshore on barges near drill rigs, near onshore terminals, and in Nome. In the absence of comprehensive land use controls, sprawling development can be expected along road systems in the CRSA linking oil terminal facilities to Nome. Such development would result in increased traffic, greater demands for public services and utilities, and strip development along the road system. Development could also increase hunting pressure on the region's fish and game populations. Residents at public meetings throughout the region requested that industry use compact, self-contained enclave development to minimize social and environmental disruption.

Chapter 13: Bibliography

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